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ABDOMINAL SURGERY

VOLUME I.

ABDOMINAL SURGERY

VOLUME I.

Geo. B. Somers
1898

ABDOMINAL SURGERY

BY

J. GREIG SMITH, M.A., F.R.S.E.

*Surgeon to the Bristol Royal Infirmary
Professor of Surgery, University College, Bristol*

Fifth Edition

VOL. I.

LONDON
J. & A. CHURCHILL
7 GREAT MARLBOROUGH STREET
(Removed from 11 New Burlington Street)
1896

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PREFACE TO THE FIFTH EDITION.

As compared with previous editions, this, the fifth, may be regarded as a new work. Much new matter has been introduced; most of the sections have been recast, and several have been entirely re-written. Amongst the new material will be found articles on the Surgery of the Abdominal Parietes, on Symphysiotomy, on Subphrenic Abscess, on the Surgery of the Ureters, and on various other subjects of less importance. The articles on Hysterectomy for Myoma; on Enterectomy and allied operations; on Gastric Ulcer, and on Appendicitis have been re-written and greatly extended.

These additions and extensions have resulted in a considerable increase of the bulk of the work. Such increase was unavoidable if a due proportion was to be maintained between the amount of our knowledge and the space devoted to its presentment. It is a significant fact that the space given to Appendicitis compares with that given to Ovariectomy, and that to the Surgery of the Intestines more space is devoted than to the whole Surgery of the Ovaries. It simply means that fuller knowledge is bringing the various departments of Abdominal Surgery into their natural proportions, and that we are able to present a subject with a fulness in some measure corresponding to its importance.

Over one hundred and forty new engravings have been introduced. For most of these I am responsible. For permission to use several anatomical engravings I am indebted to the authors, and to Messrs. Churchill, the publishers, of Morris's *Anatomy*; Messrs. Lockwood and Rolleston have provided me with their illustrations of the Anatomy of the Vermiform Appendix; Dr. Macnaughton Jones has lent me his clichés of Howard Kelly's instruments for cystoscopy; Mr. T. Paul, of Liverpool, gave me blocks of drawings illustrating his operative methods; and Dr. Paul Vallin, of Lille, the translator of my work into French, has permitted me to copy four engravings illustrating the anatomy of the Kidney which he introduced into the Fourth Edition. My colleague, Professor Fawcett, drew the figure illustrating the anatomy of the Ureters. To all these gentlemen I desire to express my hearty thanks.

I desire also thankfully to acknowledge the generous help of friends and pupils. In the laborious work of collating and abstracting the voluminous literature I have been greatly assisted by my friend and colleague, Dr. James Swain. To my old pupil, Mr. Dundas Edwards, I am indebted for the index to the first volume, and to my present pupil, Mr. Mitchell, for the General Index. In the correcting of proofs, Dr. Rogers, Mr. Harsant, Mr. Edwards, Dr. Swain, Mr. Carwardine, and others have given much kind help.

CLIFTON, BRISTOL,
July, 1896

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SECTION I.

DIAGNOSIS OF ABDOMINAL TUMOURS.

SUMMARY.

TOPOGRAPHICAL ANATOMY OF THE ABDOMEN, 3.

THE REGIONS OF THE ABDOMEN, 5.

DIAGNOSTIC METHODS, 9.

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DIAGNOSIS OF ABDOMINAL TUMOURS.

THE diagnosis of tumours in the abdominal cavity demands an accurate comprehension of the topography of the contained viscera, a practical acquaintance with the methods of physical examination, and some knowledge of the nature of the tumours which are liable to be found in connection with the individual organs.

Topographical Anatomy of the Abdomen.

For purposes of surgical diagnosis we may consider the whole of the abdominal and pelvic cavities as one. The surgical limits of the abdomen are practically those of the peritoneum; anything totally or partially covered by peritoneum we may here reckon as abdominal.

The abdominal cavity is, roughly speaking, a cylinder, flatly cordate in transverse section, pointed or arched at its extremities. The inward bulging of the vertebral column tends to bisect the

cylinder in its upper portion; in its lower portion this bony ridge is bifurcated and carried outwards laterally, as the pelvic brim. At the top is the diaphragmatic arch; at the bottom is the pelvic cup, supported by the muscles in the pelvic floor.

The walls of this cavity are chiefly bony behind and muscular in front. At both extremities it is encased in bony walls, completely behind and partially in front; at the upper end by the lower ribs descending laterally and ascending in front, leaving a V-shaped gap, which is occupied by muscle; at the lower end by the iliac bones, which complete the enclosure behind and laterally, but leave a muscular space between them in front. Behind, the sacrum below and the vertebral column above, measured by inches; in front, the pubes below and the end of the sternum above, each not longer than one inch, complete the bony portion of the cylinder.

Thus the outer muscular coverings of the abdomen represent a sort of lozenge-shaped area, the four corners of which lie at at the xiphoid cartilage, the pubes, the right loin and the left loin. In this area all abdominal tumours, if bulky enough, bulge outwards; and through this area the diagnosis and the treatment of abdominal tumours are mainly carried out. Through the upper muscular boundary of the diaphragm the abdomen cannot, without danger, be entered; but through its lower boundary of the pelvic floor we may derive important aids in diagnosis, and carry out more than one mode of treatment.

It will be seen that in diagnosing conditions of abdominal viscera, we begin by trying to eliminate the parietes; to ignore, or at least to overcome, as far as possible, the obstacles which they present to examination. Where the abdominal wall is thinnest and most lax, in front, examination is easiest; in the loins, where the layers are thick and tense, examination is difficult; behind and under the bony walls, except by special methods in a few cases of certain diseases, physical examination is impossible. The anatomical construction of the abdominal walls does not here concern us: this will be considered when speaking of treatment.

The Regions of the Abdomen.

The classical subdivision of the abdomen into nine regions has been accepted by all anatomists; but this unanimity has not been carried into the fixation of the four lines which limit these regions. More than thirty systems of subdivision have, as Anderson* points out, been introduced. The truth is, that an accurate topography of the abdomen is impossible. However we limit the regions, the organs refuse to confine themselves to the spaces allotted to them. This, to begin with, blunts the keenness of the surgeon for accurate anatomical outlines. Then the limiting points themselves from which the lines are drawn are either variable or not easily detected. As a result of this, clinical descriptions as a rule ignore the classical regions, and are content to speak of the upper and lower abdomen, right, middle and left. Such a division, from the surgical point of view, would undoubtedly be clear and sufficient; and Anderson himself would prefer it, from the anatomist's point of view. The umbilicus is the natural and visible centre of the abdomen; a horizontal plane drawn through the umbilicus divides the abdomen into upper and lower segments. Two vertical planes, each passing through the middle of Poupart's ligament, subdivide each segment into three—right, middle, and left. To say that a tumour fills the left upper abdomen is to locate it at once, and mostly with sufficient exactitude. But other terms are in use, and these must be described.

Attempts are being made by anatomists to render more precise and accurate the generally described topography of the abdomen. Cunningham† makes a simple and natural subdivision of the cavity by two vertical and two horizontal planes. The vertical planes pass through the middle of the ligaments of Poupart. The horizontal planes are at the level of the lower costal margins, and the highest part of the iliac crests respectively. The former is called the "subcostal plane"; the latter, the "inter-tubercular." Anderson would make the upper horizontal plane

* Morris's *Treatise on Anatomy*, p. 1247.

† *Manual of Pract. Anat.*, vol. i., p. 445.

practically the same as Cunningham; the lower plane he would place at the level of the anterior iliac spines.

The method of segmentation here adopted is that of Anderson. It is the same as that of Tillaux adopted in previous editions, except that the line *a.a'* in the diagram (fig. 1) is lowered from the level of the eighth rib to that of the lowest point of the costal margin. Cunningham's topography, however valuable anatomically, is clinically unsatisfactory, for these reasons; namely, that in many subjects the umbilicus lies outside the umbilical space as he places it, and that in others or the same subjects there is no umbilical space at all; while in most the space is very cramped.

The nine segments are mapped out by four lines, two vertical and two horizontal, drawn from fixed points on the surface. The upper transverse line (*a.a'*) is at the level of the lowest costal margin; the lower (*b.b'*) passes through the anterior superior spines of the iliac bones. The vertical lines (*c.c'*, *d.d'*) are drawn through the middle of Poupart's ligaments on each side. The upper and lower limits are at the diaphragm and the pelvis. The middle regions are named, from above downward, the Epigastric (fig. 1, I.), the Umbilical (IV.), and the Hypogastric (VII.). The lateral regions, from above downward, are named respectively right or left Hypochondriac (II. and III.), Lumbar (V. and VI.), and Iliac (VIII. and IX.).

The contents of these regions are graphically shown in the following table, compiled by Anderson* (p. 8).

* *Loc. cit.*, p. 1249

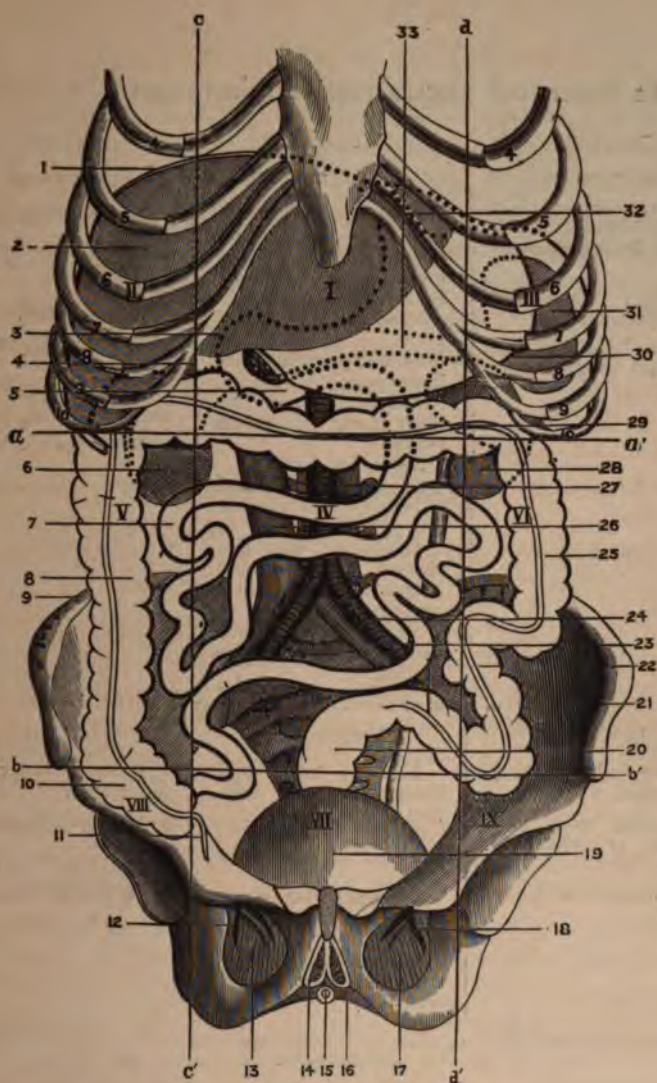


FIG. 1 (after Tillaux).

Showing the Regions of the Abdomen and their Contents.

I. Epigastric. II. Right Hypochondriac. III. Left Hypochondriac. IV. Umbilical.
V. Right Lumbar. VI. Left Lumbar. VII. Hypogastric. VIII. Right Iliac. IX. Left Iliac.

1. Diaphragm. 2. Liver, 3. Pylorus. 4. Gall-bladder. 5. Duodenum. 6. Right Kidney.
7. Small Bowel. 8. Ascending Colon. 9. Iliac Crest. 10. Caecum. 11. Appendix Vermiformis.
12, 18. Obturator Vessels, R. and L. 13, 17. Obturator Membrane. 14, 16. Corpora Cavernosa.
15. Urethra. 19. Bladder. 20, 22. Rectum, Sigmoid Flexure (should be Ω-shaped). 21. Left
Ilium. 23, 24. Iliac Vessels. 25. Descending Colon. 26. Vena Cava inf. 27. Aorta. 28. Left
Kidney. 29. Transverse Colon. 30. Greater Curvature of Stomach. 31. Spleen. 32. Cardiac
Orifice of Stomach. 33. Pancreas.

The Abdominal Viscera regionally arranged. (Anderson.)

RIGHT.	MIDDLE.	LEFT.
HYPOCHONDRIAC.	EPIGASTRIC.	HYPOCHONDRIAC.
<i>Liver</i> : portion of right lobe (gall-bladder, usually cut by longitudinal line).	<i>Liver</i> : quadrate, caudate, Spigelian, and greater part of left lobes (gall-bladder usually cut by longitudinal line).	<i>Liver</i> : portion of left lobe.
<i>Kidney</i> : upper and outer part.	<i>Pancreas</i> : head and body.	<i>Spleen</i> : lower and outer part.
<i>Colon</i> : hepatic flexure and part of ascending colon.	<i>Spleen</i> : upper and inner part.	<i>Pancreas</i> : tail.
	<i>Kidneys</i> : upper and inner part, with pelvis renalis.	<i>Kidney</i> : upper and outer part.
	<i>Suprarenal bodies</i> .	<i>Stomach</i> : great <i>cul-de-sac</i> .
	<i>Stomach</i> : middle and pyloric regions, cardiac and pyloric orifices.	<i>Colon</i> : splenic flexure.
	<i>Duodenum</i> : first and second portions and termination of third portion.	
	<i>Small intestine</i> : transverse colon, variable portion.	
LONGITUDINAL PLANE ALONG OUTER BORDER OF RECTUS.		
UPPER HORIZONTAL PLANE AT LEVEL OF LOWEST POINT OF COSTAL BORDER.		
LUMBAR.	UMBILICAL.	LUMBAR.
<i>Kidney</i> : lower and outer part.	<i>Kidneys</i> : lower and inner portions, with ureters.	<i>Kidney</i> : lower and outer part.
<i>Ascending colon</i> and portion or whole of <i>cacum</i> .	<i>Duodenum</i> : lower flexure and part of third portion.	<i>Small intestine</i> : chiefly jejunum.
<i>Small intestine</i> : chiefly ileum.	<i>Jejunum</i> and <i>ileum</i> .	<i>Descending colon</i> and portion of <i>sigmoid flexure</i> .
	<i>Transverse colon</i> : portion.	
	<i>Sigmoid flexure</i> and commencement of <i>rectum</i> .	
LOWER HORIZONTAL PLANE AT LEVEL OF ANTERIOR SUPERIOR ILIAC SPINES CARRIED INTO TRUE PELVIS.		
INGUINAL.	HYPOGASTRIC.	INGUINAL.
<i>Small intestines</i> .	<i>Small intestines</i> .	<i>Small intestine</i> .
<i>Cacum</i> : lower portion, occasionally.	<i>Sigmoid flexure</i> and <i>rectum</i> (portion).	<i>Sigmoid flexure</i> : portion.
<i>Inguinal canal</i> .	<i>Cacum</i> : occasionally.	<i>Inguinal canal</i> .
	<i>Ureters</i> .	
	<i>Bladder</i> : in children, and if distended in adults.	
	<i>Fundus uteri</i> and appendages.	

Tumours first appear in the situation of the organs from which they grow; and their main attachments are the same. Even if they encroach upon other regions, as they very frequently do, abdominal tumours have the greater part of their bulk in the normal situations of the organs from which they spring. These facts are of supreme importance both in diagnosis and in treatment, and necessitate a further and detailed description of the relations, anatomical and surgical, of each organ from which tumours grow. This description will be given separately for each organ.

Diagnostic Methods.

Certain methods of examination of the abdomen in a patient suspected of abdominal disease are followed. They are :

Inspection ;

Palpation through parietes, vagina and rectum ;

Percussion ;

Auscultation ;

Exploratory Puncture.

Inspection.—If the patient is in bed, we note the position naturally assumed. We note any lack of freedom in movement, as in raising the head, in turning, or in drawing up the limbs. Any inflammation in the abdomen is inconsistent with free movement. If the patient lies very still, with the knees drawn up, we may suspect peritonitis. If, while there is much pain, the patient moves restlessly about, perhaps rolling on his face or assuming the genu-pectoral position, we may suspect colic or some form of acute intestinal strangulation.

The abdominal walls are inspected while the patient lies comfortably in the supine position. We note the size of the abdomen generally, and whether its bulk and symmetry are in proportion with those of the chest. We mark any irregularities on its surface, particularly observing the localities in which they are placed. Uniform swelling is observed to be flat, globular, diffuse, or circumscribed. The appearance of a bulky abdomen

with a lean chest contrasts with a depressed and shrunken abdomen in cases where the chest appears of normal development. We further note every peculiarity in the parietes: their fatness or leanness; whether they are white and glossy, or red and dull; whether the skin is distended with œdema, or shrivelled and puckered; whether the veins are dilated or not; and, in fact, everything which can be interpreted as being in the slightest degree abnormal.

The movements of the abdomen are watched—first during easy respiration, and then during deep respiration. The abdominal walls may move readily and freely, or they may remain fixed while the chest moves. Any conspicuous point, as the umbilicus, may sometimes be seen to glide up and down over a growth, or the growth itself may visibly move upwards and downwards with each act of expiration and inspiration.

Palpation.—For palpation of the abdomen the patient is placed supine in bed, with the knees drawn up and the head slightly elevated, to give relaxation of the abdominal muscles. Too much flexion of the spine, while giving greater relaxation of the abdominal walls, defeats the object of palpation by deepening the antero-posterior measurement and crowding the contents forward. A thin abdomen, or one relaxed by repeated pregnancies, is more easily examined than a fat abdomen or one of a woman who has never borne children. A stout muscular man presents the abdomen most difficult to examine by palpation.

While palpation is being performed the attention of the patient is diverted by questions about the symptoms and so forth, which will ensure a natural condition of the abdominal walls. Any special instructions, as, to breathe deeply or to count, have a tendency to call attention to the process of examination rather than to divert attention therefrom.

The palm of the hand, which must not be cold, and which is said to be made more sensitive by being dipped in hot water, is laid flatly on the abdomen and pressed steadily and firmly, but not roughly, downwards. When it is depressed as far as possible, if no tumour prevents it, the hand is rotated outwards, and its

outer margin and fingers may be pushed deeper, so as, without causing much discomfort, to reach the spine and perhaps the brim of the pelvis. The pressure being steadily maintained, the hand, and the abdominal wall with it, is moved hither and thither over the abdominal contents. The hand is not to be moved over the parietes, but the parietes and hand together are to be moved over the abdominal organs. Without raising it, the hand is slid on to another area, and the process repeated till the whole abdomen has been explored.

By this means we shall make out any small or deeply-placed tumour, such as cancer of the pylorus or pancreas; movable kidney; abdominal aneurism; mesenteric, omental or peritoneal growths; and small tumours of the ovary that may have escaped from the true pelvis. In this way also we shall be able to detect any undue degree of spasm or tension of the abdominal muscles, pointing to underlying irritation or inflammation. We enquire into, and observe the expression of, the sensations of the patient while being examined. In some cases, usually of colic, pressure affords relief. In others, pain, in all degrees from the slightest to the most severe, may be caused by pressure. In every case it is important to discriminate between the hyperæsthesia of the nervous or hysterical patient and the genuine tenderness begotten of inflammation. In inflammation the pain is usually limited to the inflamed area; in simple hyperæsthesia the pain radiates in various directions over the skin of the chest, thighs, or back.

If a tumour is visible, we seek by palpation to elucidate as many of its characters as possible. Is it circumscribed or diffuse? Is it solid or fluid? Is it fixed or movable? In the case of a circumscribed tumour that is not very large, the hand may be partly insinuated between it and the resisting bony boundaries. The feel of a solid growth is characteristic: between a semi-solid or boggy growth and one distinctly fluid there are many grades difficult of recognition. We seek to detect the condition by trying to elicit the sign of fluctuation. While the fingers or the palm of one hand lie firmly pressed on one side of the growth, the fingers of the other tap it on the opposite side; if the swelling is fluid, we feel a thrill or series of vibratory thrills. The fluctuation

thrill may not be detected in fluid tumours if their cyst walls are thick and tense, or if the fluid is thick or contained in many cysts. To detect mobility, the hand is laid flatly on successive aspects of the tumour, and endeavours to move it in various directions; or the tumour may be grasped bodily between the hands, and movement given to it.

By palpation also we seek to make out any irregularities on the surface of the growth, or any localised differences of consistence in its mass. The fingers will note any sensation of grating or fremitus on its surface indicating peritonitis, or they may feel that the parietal peritoneum glides readily over the tumour.

New facts may be discovered by turning the patient, first on one side and then on the other. These relate chiefly to mobility, the extent and direction of it, or its non-existence; but these characters are, perhaps, better ascertained by the palpating hand than by change of position.

Palpation by vagina in all abdominal tumours not high up, and not small, is of great diagnostic value. By this plan we may be able, not only to elicit important facts as to the physical character of the tumour, but also to make out its connection or non-connection with the uterus. Not infrequently the tumour may be poised between the finger in the vagina and the hand on the abdominal wall, and the situation and attachments of its pedicle or base made out. Very often a tumour which, through the abdominal walls, gives the characters of a single cyst, is found through the vagina to have its lower portion composed of several cysts, and, frequently, of solid material as well. The use of the uterine sound is an aid to vaginal palpation. By means of it we can ascertain with accuracy the length of the uterine cavity, the extent and range of mobility of the fundus, and the situation of the whole organ generally with reference to the growth. In not a few cases the uterus lies immediately behind the pubes, and its fundus can be readily palpated through the abdominal wall; while the whole organ may be moved between the fingers of one hand placed outside on the fundus, and of the other placed inside on the cervix. Often, again, it is pressed downwards and retroverted,

and its outlines can be made out in Douglas's pouch. The middle finger in the rectum, with the forefinger in the vagina, the perineum between them being pushed upwards, will give more information usually than the simple finger in the vagina; but this plan is not always agreeable to the patient.

Palpation by the rectum may be carried out in the manner just mentioned, or by the finger in the rectum alone, or by the whole hand introduced while the patient is anæsthetised. Very rarely indeed can the last method, in itself an operation of some severity, be considered advisable. Only in certain cases of extreme difficulty, in which it is of vital importance that operation, even exploratory, should not be undertaken till diagnosis is certain, is it admissible. The results, it is very generally admitted, of manual exploration through the rectum are often disappointing. Few surgeons, even among those of the largest experience, have had recourse to this method of diagnosis.

Percussion.—Percussion of the abdomen is performed while the patient is in the same position as for palpation—that is, in the supine posture with knees drawn up. But change of position, first to one side and then to the other, though but slightly adding to the value of palpation, introduces important aids to diagnosis by percussion. The practice is best carried out by tapping the fingers of the left hand, placed on the abdomen, with the fingers of the right hand. If a wide area is to be percussed, it is a good plan to percuss by successive taps on one finger after another while they are spread out as much as possible over the abdomen. If the wrist and fingers are kept stiff, and pressure is made with the arm, more uniform force is exerted, and more exact comparison is possible than if only one finger is used, and moved from one spot to another. Some prefer always to use a pleximeter.

It is of great importance to bear in mind the different values of deep and of superficial percussion. A “minimised note,” produced by gentle taps, will reveal increased dulness in small or thin solid bodies, which would not be detected by strong percussion. A thickened omentum, or pelvic cellulitis extending up

into the abdominal parietes, or a small growth lying over the intestines, would be revealed in this way. Deep percussion, again, may reveal dulness from a growth covered by intestines, which would give a resonant note to superficial percussion. In those parts where the abdominal walls are thick, as in the loins, superficial percussion is useless, as it reveals only the dulness caused by the thick muscles.

In examining the whole abdomen, particular attention is to be paid to the umbilical, the epigastric, and the lumbar regions. Free fluid in the peritoneal cavity, always gravitating to the lowest part, is first detected, if the patient is recumbent, by percussion in the lumbar regions. Circumscribed and movable growths have a tendency to rise above the intestines to the surface. It must be remembered that a dull note in the flanks may be caused by fluid *fæces* in the intestines; and further, that this dulness may be changed to resonance by turning the patient on one side, and so causing the fluid-laden intestines to gravitate away from the surface. Again, a colon distended with gas may cause resonance in the loin even when ascites is present. When only a small amount of fluid lies in the abdominal cavity, the mesentery is long enough to permit the gas-containing intestines to float to the surface, thus giving a resonant note.

In the case of a tumour being visibly and palpably present, percussion is chiefly valuable as eliciting the position of resonant intestine. Sometimes the tumour is all gas-containing intestine—meteorism or phantom tumour. Occasionally tracts of resonance passing over a growth indicate the presence of adherent bowel. In circumscribed collections of putrid pus a resonant note often indicates the presence of a superstratum of gas. But in the great majority of cases percussion is of value chiefly as demonstrating the "tympanic corona" (as Tait well names it), which surrounds a growth overlying or displacing intestine, in contrast with the circular, semi-circular, or crescentic area of resonance which is found in cases of peritoneal dropsy.

In diagnosing ascitic fluid from cysts, in detecting slight enlargements of liver and spleen, and in demonstrating the presence of gas in a swelling, percussion is of great value: in all

other respects, as a diagnostic method, it is much inferior to palpation skilfully practised.

Auscultation.—As a method of physical diagnosis applied to the abdomen, auscultation has not as yet been very fruitful of results. Vascular bruits in aneurisms, and in fibroid or sarcomatous tumours, friction-sounds in peritonitis, and the sounds of the fœtal and the placental circulation, are the most important revelations of the auscultatory method. There are signs that the use of the stethoscope in differentiating intestinal sounds may be of clinical value. Such sounds, produced by the mingling of fluid and gas during intestinal movement, and described as metallic, gurgling or splashing, may be heard during health, and, no doubt, in modified manner during disease. But clinical data as to the character of the sounds are not yet definite enough to be of practical use. In certain cases of dilatation of the stomach, in cholera and diarrhœa, augmentation or perversion of these sounds can be detected. In intestinal obstruction, any such addition to our powers of diagnosis would be heartily welcomed; but as yet no very definite clinical facts have been established by auscultation. In chronic obstruction, the seat may sometimes be determined with some degree of accuracy by noting the point where intestinal gurglings are loudest and most prolonged.

Exploratory Puncture.—Removal of a small portion of the contents of an abdominal tumour by a hollow needle attached to an exhausting syringe, is a method of diagnosis of somewhat uncertain value. In many cases it is useless; in others it makes a diagnosis which does not modify the treatment; in a few cases it is of real and decided benefit. There can be no doubt that the method has been employed with undue frequency, having been adopted to solve difficulties which ought by other means to have been overcome. Furthermore, it is sometimes attended with danger, and has even caused death. Perhaps the best criterion of the value of exploratory puncture is the fact that it is very rarely used by our most skilled and experienced operators.

If it is decided to employ the exploring needle, particular care

must be taken to see that the instrument is sterilised by boiling or other trustworthy method. The skin at the site of puncture must also be purified; for a group of epidermic scales, or even a small piece of skin, may be carried along by the point of the needle and cause sepsis. Not a few cysts have undergone septic suppuration as a result of the introduction of the exploring trocar; therefore every possible precaution ought to be taken to avoid such a catastrophe.

Physical Examination of the Individual Organs.

The Liver, 16.

The Kidneys, 19.

The Spleen, 22.

The Pancreas, 23.

The Stomach, 23.

The Intestines, 26.

The Omentum, 27.

The Uterus and its Appendages, 27.

THE LIVER.

Palpation.—In health, all of the liver that can be felt is its lower margin where it lies below the ribs, and a portion of the anterior surface of the left lobe in the epigastrium. In men, it may be impossible to palpate the liver at all, or it may simply be detected as a line of increased resistance. In women, and particularly in those who have lax parietes from child-bearing, the hepatic margin can usually be distinctly felt and traced. While the fingers examine the condition of the portion of liver within reach, we take cognizance of the freedom with which the organ moves during the acts of respiration. We note also any complaints of pain or tenderness during palpation. When the liver is enlarged it descends within easy reach, and its surface is carefully examined for abnormalities. Hardness, or bogginess, or fluctuation; irregularities of surface—their size and consistence; and the general form of the enlargement, are the points to be mainly attended to. Hepatic fremitus from peri-hepatitis and

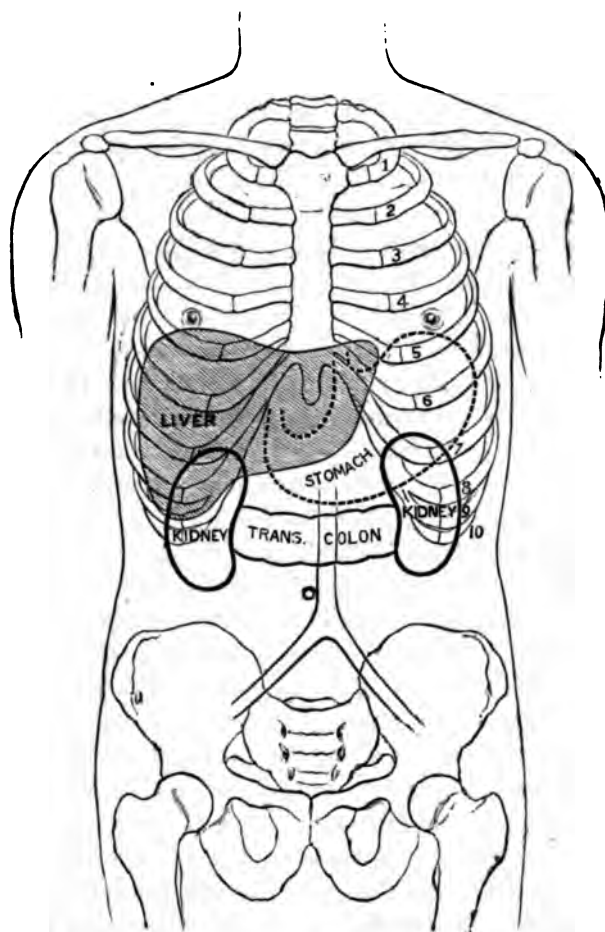


FIG. 2.

Relations of the Abdominal Viscera to the Parietes (TREVES).

FRONT VIEW.

hydatid fremitus may be felt by the hand. A distended gall-bladder may sometimes be felt in health; and Guttman* says that by squeezing it he has caused its contents to escape through the excretory ducts. In pathological enlargement the gall-bladder is readily felt extending below the liver margin.

Percussion.—On account of the overlapping of the lung, the upper limits of the liver cannot be accurately determined by percussion. Between the highest part of liver and the thoracic wall there is such a depth of lung that a clear resonant note is given; and for a little distance lower, only relative dulness or flatness is obtained. Absolute hepatic dulness is elicited where the liver is in close contact with the thoracic wall, or, at least, not separated from it by air-containing lung. As relative dulness is very variable over the hepatic region, we use the sign of absolute dulness to define its limits. Percussion is performed during the respiratory pause, and along the four lines—sternal, para-sternal, mammary, and axillary. For defining its upper limits: in the mid-sternal line dulness is obtained at the base of the xiphoid process; in the para-sternal line, just above the sixth rib; in the mammary, at the lower border of the sixth rib; and in the axillary line it is found at the level of the eighth rib. Behind, hepatic dulness is found as high as the tenth rib. The lower limits of hepatic dulness are as follows: in the mid-sternal line, half-way between the base of the xiphoid process and the umbilicus; in the para-sternal and mammary lines, it coincides with the free margin of the ribs; in the axillary line, between the tenth and eleventh ribs; behind this, hepatic dulness is lost in that caused by the thick muscles of the back. In women, the liver dulness may extend from half an inch to an inch lower. In percussing the lower portions of the liver, a minimised note is necessary to produce absolute dulness, on account of its being thinner and lying over air-containing viscera.

As the patient lies supine, the liver rotates a little on its transverse axis, and the anterior margin slips up under the ribs,

**Handbook of Physical Diagnosis*, New. Syd. Soc., 1879.

elevating the lower limit of anterior dulness. The erect posture corrects this. The liver may be dragged up by contraction of lungs or pleura, or pushed up by growths distending the abdominal cavity. In certain diseases it becomes enlarged, often to enormous size, and in such case the increase is downwards, occupying part or the whole of the anterior abdomen. In such enlargements percussion will always demonstrate continuity in the dulness found over the hepatic area. A healthy gall-bladder cannot be detected by percussion: in disease, a dull note is given over the area of its increase.

Auscultation is of little value as a mode of examining the liver. A friction sound may be heard in peri-hepatitis.

Exploratory puncture has been frequently employed in diagnosing diseases of the liver. It is chiefly valuable in detecting the nature of fluid in cystic or suppurative enlargements: it also helps, in doubtful cases, in diagnosing whether the enlargement is solid or fluid. Rarely a small piece of tissue removed by the needle, and examined by the microscope, has revealed the nature of a new growth. The procedure is not free from danger, remote as well as immediate.

THE KIDNEYS.

Palpation.—A kidney that lies in its proper position, and is not enlarged, is, as a rule, beyond the reach of palpation. In thin subjects, with lax abdominal walls, the normal kidney may sometimes be felt. Between the fingers of one hand pressed deeply in the costo-iliac space behind, and the opposed fingers of the other hand in front, the lower third or so of the kidney may be palpated; or with one hand, the thumb being in front and the fingers behind, the loin may be firmly grasped and the kidney felt through the muscles. Size can be estimated more accurately by the grasp of one hand than between two hands: for detecting slight enlargements, palpation between thumb and fingers of one hand is perhaps the better method. If the patient lie over a pillow on the side opposite that being examined, the costo-iliac space is enlarged, and more of the kidney is exposed to palpation; but the

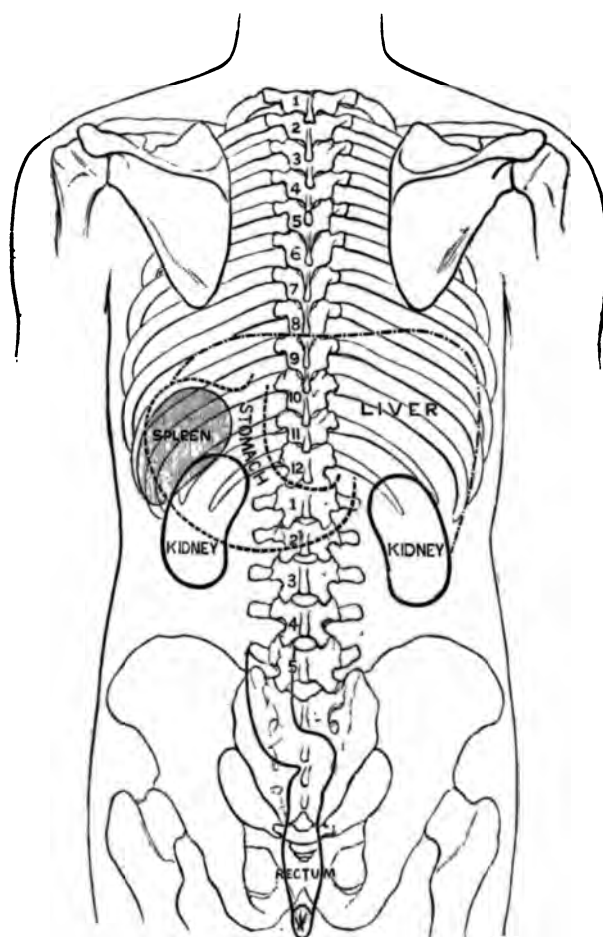


FIG. 3.

Relations of the Abdominal Viscera to the Parietes (TREVES).

BACK VIEW.

advantage so gained is partly counterbalanced by the increased tension of the loin muscles. All of the healthy kidney that can be felt is the lower third or thereabouts of its posterior border, and a little portion of its lower anterior surface; the rest is merely a sensation of something grasped with a consistency like that of kidney.

If the kidney is readily felt, we may conclude that it is enlarged or displaced. A kidney increasing in size cannot extend far upwards, and not at all backwards, on account of the lumbar muscles: it grows downwards and forwards—that is, more and more within the reach of the palpating fingers. In diagnosing displacements and undue mobility of the kidney, palpation is of great value. Tenderness on pressure, in renal as in other inflammations, is a sign of importance elicited by palpation. Fluctuation or solidity, with various degrees of hardness or softness, are all signs of diagnostic value. The grating of stones in a kidney has been felt through the abdominal walls. In cases of great enlargement, the colon may be felt passing over the surface of the tumour.

Percussion.—The kidney, being in close relation with solid bodies,—liver on one side, spleen on the other, lumbar muscles and vertebræ behind, while it is embedded in a thick capsule of fat,—cannot be mapped out by percussion. The absence of kidney from one side may, in lean subjects, give a note on percussion less dull than on the other side where it is present. If there is renal enlargement, a resonant area in the loin is encroached upon and replaced towards the front by an area of dulness. At the inner margin of the kidney, extra resonance may be obtained from the colon distended by gas. In considerable enlargement, a resonant area from a distended colon may longitudinally traverse the surface of the kidney.

Exploratory puncture is used in the diagnosis of renal tumours. It will tell whether an enlargement is solid or fluid; and if fluid, it will tell the nature of it—whether suppurative, cystic, hydro-nephrotic, or hydatid. As puncture by trocar can, in fluid enlargements of the kidney, more often than of other abdominal

organs, be continued beyond the purpose of diagnosis into a plan of treatment, its employment is most legitimate in kidney diseases. It is also safer, for the puncture may be made without entering the peritoneal cavity.

THE SPLEEN.

Palpation.—The healthy spleen is usually beyond the range of touch. In favourable circumstances, however, as in thin subjects with lax muscles, and during deep inspiration in the erect posture, the fingers insinuated below the margins of the ribs may feel the organ. By this plan slight enlargements are best detected. As the spleen enlarges, it appears at the costal margin below the site of the apex beat, and continues to increase downwards and forwards. It lies, when enlarged, immediately under the parietes over the intestines, and can readily be palpated. The characteristic sensation imparted by splenic substance, and its rounded inner margin indented with one deep notch and one or more others less deep, render the diagnosis of spleen by palpation comparatively easy. Its rounded posterior margin, if it do not lie behind the border of the quadratus lumborum, may sometimes be differentiated. The spleen, even when greatly enlarged, is usually movable in lateral direction.

Percussion.—The spleen, as it lies over air-containing organs, must be percussed gently. Differences in the area of dulness may be elicited as the patient lies on the back or side, as he stands up, and as he forcibly expires or inspires. In the erect posture, the spleen descends; as the patient lies on the right side, it gravitates away from the surface; in expiration the lung ascends from it, and increases its area of dulness; in inspiration the reverse takes place, a forced inspiration sometimes causing the splenic dulness completely to disappear. The upper third of the spleen cannot be recognised by percussion. Generally speaking, the splenic dulness in its most marked condition with the patient erect, and in the pause after expiration, is represented by an oval patch lying midway between the scapular and axillary lines, and bounded above by the upper border of

the ninth rib, and below by the lower border of the eleventh rib. The healthy spleen may be pushed downwards by any pathological increase in the size of the left pleural cavity: it may be pushed upwards by ascites, tympanites, or any growth filling the abdominal cavity. It is usually indistinguishable by percussion from any non-resonant tumour or collection of fluid which displaces it.

Auscultation.—A vascular bruit is sometimes to be heard over an enlarged spleen. If there is inflammation of its capsule, friction-sounds may be audible during respiration.

THE PANCREAS.

Except in very thin patients, the pancreas cannot be felt. The head of the pancreas can sometimes be recognised as a small hard elevation, a little above and to the right of the umbilicus: the body and tail cannot be palpated. The genu-pectoral posture and bimanual pressure from both sides inwards are said to facilitate palpation of the pancreas. The gland is always fixed in disease as well as in health. The diagnosis of growths of the pancreas, solid and cystic, is always difficult and sometimes impossible, and many examples of errors could be quoted. I have had part charge of a case in the Bristol Infirmary where an aneurism in the substance of the pancreas was, for more than a month, supposed to be tumour of the gall-bladder.

Other methods of examination are absolutely useless. In growths of the pancreas lying close to the abdominal wall, exploratory puncture may be employed with doubtful advantage.

THE STOMACH.

Inspection.—In health, some idea as to the emptiness or fulness of the stomachic cavity may be got by inspection. In disease, there is a marked contrast between the depression of the epigastrium in a patient with cesophageal obstruction and the tumefaction of the upper abdomen seen in cases of stomachic distension from obstruction of the pylorus. Sometimes, in a

dilated stomach, peristaltic movements may be visible through the parietes. Not infrequently a new growth in the walls of the viscus is visible as an elevation in the epigastrium.

Palpation.—By touch we can detect dilatation of the stomach with fluid or gas, and the existence of a growth in its walls. Local pain—an important sign in diseases of the stomach—may be elicited by pressure. A pyloric growth in its early stages is movable; later on it becomes fixed. Sometimes, on account of dilatation of the stomach, a pyloric tumour is displaced downwards from the normal position of the pylorus in the epigastrium. Tumours in the wall of the stomach descend by gravitation. Tumours in the left half of the stomach, which however are of rare occurrence, cannot, as a rule, be detected by palpation. Vermicular contraction of the stomachic walls may occasionally be felt by the examining finger.

Percussion.—Only that portion of the surface of the stomach which is in contact with the abdominal walls can be satisfactorily percussed; the sounds over the rest of the stomach are rendered uncertain in import by the overlapping of the liver and the lung. The margin of the left lobe of the liver on the right, and the lower border of the left lung on the left, mark the upper boundaries of pure stomachic resonance: the lower limit, the great curvature, is represented by a curved line lying midway between the end of the sternum and the umbilicus, and joining the costal margin at the free end of the tenth rib. The upper limits, being marked by transitions of hepatic dulness on the right and pulmonary resonance on the left to the tympanic note given forth by an air-containing stomach, are easily mapped out. The lower limits are not so readily fixed, on account of the proximity of the colon, which frequently gives forth a percussion note identical in quality and intensity. Sometimes, however, there is a sharp distinction in the variety of note, permitting the line of the greater curvature to be marked out with exactitude.

The percussion note over the stomach is usually loud and tympanic, but low in pitch. But the note varies greatly according to the nature and amount of contents. The stomach may be quite full of fluid, when the note is dull or very much muffled,

and this dulness may extend over an area greater than is occupied by the normal undilated stomach. Air and fluid may be present together, when each will give out its characteristic note according to its amount and the position of the patient. A common condition is seen when air and fluid are both present in moderate amount ; and the stomach surface is then represented to percussion as a rounded patch of tympanitic resonance above, bounded below by a crescentic area of dulness. The metallic note described by Leichtenstern, which may be elicited in cases of over-distension by gas, is not of great clinical value. More precise results are sought to be attained by such methods as that of Frerichs, who generated carbonic acid in the cavity, and that of Schrieber, who inflated a rubber balloon introduced collapsed into the stomach, with other methods which might be mentioned ; but none of them have come into general favour.

Anything which depresses the diaphragm will depress the stomach ; and anything which distends the abdomen will push the stomach upwards. Its area of resonance is diminished by enlargement of the liver or spleen, and increased by contraction of the liver, as well, of course, as by gaseous dilatation from pathological causes proper to itself.

In every case important modifications of the percussion note may be got from changing the position of the patient. Resonance follows the movements of the gas, always to the surface ; dulness follows the fluid, which gravitates to the lowest position and drags the stomach with it.

Auscultation.—Certain splashing, gurgling, or metallic sounds are caused by the agitation of the fluid and gaseous contents of the stomach. These sounds may be caused by the natural movements of the stomach walls, or by rapid voluntary movements of the diaphragm, or by manipulation from without. Frequently they are very loud, and can be heard at a considerable distance : in such instances we may suspect some sort of pathological distension. During the processes of swallowing and digestion, gastric murmurs, of a nature not easily described, may be heard with the stethoscope.

THE INTESTINES.

Inspection.—General fulness or emptiness of the intestines causes visible protuberance or retraction of the abdominal walls. Excessive distension of the intestines by gas produces a characteristic form of enlargement. With general protuberance in the umbilical region, there is a peculiar fulness in the epigastric and lumbar regions, which belongs to no other form of abdominal enlargement. In such cases, if the parietes are thin, peristaltic movements may be seen in individual coils of intestine. Collections of fæces in the colon may appear as localised elevations at any part of its course, or even as a general enlargement of the whole abdomen.

Palpation.—It is not often that touch is of assistance in diagnosing the condition of intestine. We can feel, and often diagnose by touch, an accumulation of fæces; and it is sometimes possible by palpation alone to tell whether the contents of a distended bowel are chiefly gaseous or chiefly fluid. Occasionally peristaltic movements, in such cases of distension, are perceptible to touch. One important sign elicited by palpation is pain, chiefly of value in the diagnosis of certain inflammatory conditions in the neighbourhood of the cæcum.

Percussion.—In health, the percussion-note all over the intestine is tympanitic. The quality of the note varies according to the proportions of fluid or gas contained. Where the intestine, still full of gas, is of small calibre from compression, the tympanitic note is raised in pitch; where its walls are greatly distended by gas, the note becomes deeper in pitch, and gradually, according to the amount of distension, becomes less and less tympanitic. In conditions of extreme gaseous distension the character of the note is metallic. It is not generally known that percussion over the iliac bones, if the patient is not fat, will give a tolerably accurate idea as to the nature of the contents of the underlying bowel.

In certain cases the presence of fluid in the bowel may give a dull note in the flanks, which, when the patient turns over, slowly becomes resonant. In intestinal obstruction that has lasted over a few days, this dull lumbar note from the gravitation of fluid-

laden bowels is of by no means in frequent occurrence. I have more than once found, in intestinal obstruction, that dulness in the flanks, diagnosed as ascites, has turned out after operation to depend upon large quantities of fluid in the bowels.

Auscultation.—As already stated, the clinical value of auscultation applied to the intestine is not yet fully established. Beyond certain gurgling or splashing sounds produced by the mingling of fluid and gas in perturbed intestinal contractions, and which are found in a variety of conditions, chiefly medical, there is little in the way of definite abnormality which can be detected by the stethoscope. In several cases of intestinal obstruction it has appeared to others, as well as to myself, that those gurgling sounds were loudest in the neighbourhood of what was afterwards found to be the situation of the obstruction. It is possible to follow with the stethoscope the sounds produced in the colon by a fluid injected through the rectum; and this fact may be employed to diagnose the existence and position of any obstruction in this part of the bowel.

In perforation of the bowel, there are sometimes heard sounds of an amphoric or blowing character, caused by the gas rushing out of the intestinal opening into the general peritoneal cavity. These sounds are said to be most audible during the act of inspiration.

THE OMENTUM.

In health, the omentum is beyond the range of any of the diagnostic methods. In disease, inflammatory thickening can be detected by percussion; and tumours growing in its substance can be recognised by the methods proper to these.

THE UTERUS AND ITS APPENDAGES.

These are examined by methods special to themselves, which are fully described in works devoted to the consideration of their diseases. Our purpose in this work will be fulfilled by a short description of the methods of palpation as applied to these organs.

The best position is generally the supine. The patient lies

close to the head of the bed or couch, and the thighs are drawn up towards the chin and separated. One hand—the surgeon ought to be able to use either hand for the purpose—is laid upon the abdomen over the pubes, and gently but firmly presses the pelvic organs downwards. Two fingers of the other hand (or one finger if there is a hymen, or the vagina is narrow or tender) are carried up to the posterior vaginal cul-de-sac, and the posterior surface and lateral connections of the uterus examined as far as possible. We now seek to get the uterus between the fingers in the vagina and the hand on the abdomen. If it is retroverted, we try to turn its fundus forwards by pushing the middle finger upwards (supposing two fingers are used) in the cul-de-sac behind, while the forefinger, by a contrary movement, tries to pull the cervix downwards in front. If it is anteverted, the forefinger pushes upwards the vagina in front of the cervix, while the middle finger behind presses the cervix downwards and forwards. The result of these movements, if adroitly performed, is that the uterus in its length is fixed between the fingers in the vagina and the hand outside. Having in this way got an accurate idea of the size and consistence of the uterus itself, we direct attention to the broad ligaments, Fallopian tubes and ovaries. We simply try to make the fingers of each hand meet over these organs, palpating their condition between them. In moderately thin patients, with abdominal walls that are not very tense, it is nearly always possible, in health, to palpate the fundus uteri, and frequently the ovaries and broad ligaments. In diseases producing enlargement, these, and the Fallopian tubes as well, can be made out with considerable precision. In diseases not connected with increase of bulk, the production of pain on pressing in certain localities is a most valuable aid in diagnosis.

Nothing is said of the uterine sound. In bimanual examination, which is by far the most perfect method of exploring the uterine organs, its use is not called for. And in uterine diseases generally it is used with much less frequency than it was a few years ago. In cases of tumour, uterine or doubtfully uterine, it will tell us the direction which the uterine canal takes, and, with some uncertainty, the length of the cavity; otherwise, it gives

little information which cannot more accurately be got by other means.

In some cases the examination is rendered more complete by turning the patient on her side in Sims's position, and examining after the manner described. In this position the uterine organs usually rise upwards, away from the examining fingers; but this disadvantage is sometimes counterbalanced by the greater laxity of the tissues in and around the vagina.

Conditions Simulating Abdominal Tumours.

In every case of abdominal enlargement, we must be assured of the absence of certain abnormal conditions which simulate new growths. The most important of these are:

Distended Bladder.

Fæcal Accumulation.

Phantom tumours, Pseudo-cyesis.

Obesity of Abdominal Walls and Omentum.

Tympanites.

Edema of Abdominal Wall.

Distended Bladder.—As no surgeon who undertakes the surgical treatment of an abdominal tumour is likely to be misled by this condition, it need be little more than mentioned. A history of retention or of diminished discharge of urine, median dulness from the pubes upwards as far as, or even beyond, the umbilicus, with a rounded fluctuating tumour in this region and resonance in the flanks, are the ordinary symptoms. In any case of doubt catheterisation will settle the question. It must not be forgotten, however, that a distended bladder may accompany an abdominal tumour. This may happen from direct pressure on the urethra by the tumour, or by stretching of the urethra by a growing tumour which is adherent to the bladder wall. Retention of urine is often the most prominent symptom of retroversion of the gravid uterus.

Fæcal Accumulation.—A collection of fæces in the large bowel may be mistaken for a new growth. The collection may be found in the abdomen wherever the large bowel may be found; and that is, practically, anywhere. It is now well known, especially through the investigations of Treves, that the transverse colon may become bent and elongated so as quite to reach the pubes, and fæcal accumulations may be found in any part of it.

A tumour of hard or doughy consistence, occasionally capable of being moulded, movable, and lying on the surface of the intestines close to the abdominal wall, may be fæcal. In size it may vary from that of a small orange to almost any dimension. When fluid or semi-fluid, its peculiar want of tension, and the absence of definite fluctuation, will probably strike us. Tympanitic distension of the bowel lying near will be found if there is obstruction as well as accumulation. A regular action of the bowels must not be taken as contra-indicating the presence of a fæcal mass; diarrhœa even is not uncommon. In cases of long-standing accumulation, diarrhœa, probably due to the formation of "stercoraceous ulcers," is the rule rather than the exception.

In all cases the existence of the condition will be proved by the administration of purgatives and enemas. If symptoms of intestinal obstruction are present, the chances of mistake are diminished.

Phantom Tumour, Pseudo-cyesis.—Phantom tumour is a localised and symmetrical enlargement of the abdomen, containing gas; pseudo-cyesis is the same associated with symptoms of pregnancy. Though similar, the two conditions are not identical. Pseudo-cyesis, or "spurious pregnancy," is most frequently found in women who have married late in life, and who are anxious for children.* Phantom tumour may occur in unmarried women, and in women who have borne children and are conscious that their condition is in no way connected with

* An excellent example of the species is depicted with admirable humour and effectiveness by Smollett in the person of Mrs. Trunnion, in *Peregrine Pickle*.

pregnancy. Both conditions have been associated with hysteria. Rarely is phantom tumour found in males.

A case of ordinary phantom tumour may present no physical signs beyond this tympanitic enlargement. A rounded, symmetrical, movable tumour, of size varying between that of a large orange and a child's head, occupying the middle of the abdomen, not fluctuating, and resonant on percussion, is probably a phantom tumour. Examination by the vagina gives negative information. A decisive diagnosis is afforded when the patient is anæsthetised; the tumour then disappears spontaneously, though it may return as consciousness returns, or even before this.

Pseudo-cyesis is a more complex affair. Though it is undoubtedly most common in elderly women anxious for children, and in whom symptoms of ovarian or uterine disease are present, it occurs also in young women in whom no such peculiarities exist. The remarkable case of an ass, recorded by Dr. Haughton of Dublin, would seem to show that the condition exists in the lower animals. The mimicry of pregnancy is sometimes very exact. Amenorrhœa, swelling of the breasts with pigmentation of the nipples, and morning sickness may all be present with the abdominal enlargement. At the presumed full term a false labour may take place.

In such cases, Tait thinks that a power of air-swallowing, as seen in crib-biting horses, may account for the condition. He calls attention to the frequent presence of loud intestinal gurglings in these women, and thinks their condition is caused partly by this spurious flatulence, and partly by peculiar muscular rigidities which they are prone to indulge in. No doubt the infirmity, if voluntarily produced, is an outcome of "that insatiable love of attracting attention so deeply rooted in the female mind," and is, as might be expected, most frequently found "in women to whom nature has denied the external attractions of beauty, or in whom there is not the compensation of a refined and cultured intellect."* Many speculations as to the origin of phantom tumour have been indulged in; probably Tait's account

* Tait, *Dis. of Ovaries*, 1883, p. 206.

represents the full amount of our scientific knowledge of the curious ailment.

Obesity of Abdominal Walls and Omentum.—More than once the abdominal cavity has been entered to remove a tumour which turned out to be fat. The simulation of abdominal growths by fat in the parietes or the omentum, or both, is sometimes so close that considerable care may be required in their discrimination. If obesity is general, we are more likely to be on our guard; but if, as sometimes happens, especially near the climacteric, there is a large deposit of fat in the abdomen, while the limbs do not increase in bulk, or even get thinner, the condition is more misleading.

In such cases the possibility of grasping and raising from the abdominal muscles masses of fatty tissue, the absence of any localised area of dulness, and the negative results of vaginal examination, will be our chief guides in diagnosis. A fat omentum is clinically, perhaps, an abdominal tumour; but pathologically, there is no growth of similar thickness and consistency which is spread so evenly over the bowels.

Œdema of Abdominal Wall.—Great œdema of the abdominal wall has been mistaken for abdominal tumour; but the error must be of rare occurrence. A concomitant thickness and hardness of the subcutaneous tissues, preventing pitting on pressure, would seem to be necessary to render the mistake even possible. The absence of all the physical signs of abdominal tumour except increase in size, with the presence of such signs of disease in the system as would account for the œdema, should help the diagnosis. It should be remembered, however, that œdema sometimes accompanies abdominal tumour.

Tympanites.—At least seven cases are on record where an abdomen has been laid open to find only gas. In phantom tumour this would be impossible, for the swelling disappears with the anæsthesia. The mistake, in the light of our present

knowledge, seems almost inexcusable. On the other hand, it is just possible to overlook the presence of a tumour because it is resonant all over its surface. I have removed a large putrid suppurating cyst, over the whole surface of which resonance could be demonstrated on the operating table to a number of students and medical men. Half its contents were gaseous. But it could be palpated.

Having eliminated these spurious complaints, and having decided that the abdomen contains a real tumour—a foreign development constituting disease—our next duty is to make out what this tumour is. In working out the diagnosis, it is well to follow certain lines with the mind that reasons, as well as with the senses that explore. These lines need not be laid down by science; they may be purely practical, if only they are useful. Our purpose being simply diagnosis, we are justified in adopting any procedure which will most quickly and certainly bring out the physical features of the disease. Thus, while we group together all tumours of the ovary for purposes of classification and description, for diagnosis we rather compare solid tumours of the ovary with pedunculated myomata of the uterus. A large ovarian cyst may have more physical signs in common with a cyst of the kidney than with any pathologically allied growth, uterine or ovarian.

The rarity of a disease may be a cause of meagre scientific acquaintance with it; but for diagnostic purposes, all diseases have equal importance. In abdominal surgery, in particular, it is just those rare diseases that we chiefly wish to exclude. Probably, most of the errors in abdominal surgery are made in this way. The ordinary broad signs of ovarian disease may in a score of cases have guided our diagnosis correctly, when a twenty-first case turns up with an exact repetition of all these signs, and we find ourselves in error. We have probably overlooked one or two little signs of the rare disease, because we thought little of it. We dare not essay to perform operations on the abdomen till we are familiar with the diagnosis of all

abdominal tumours; and we cannot pretend to diagnose positively any one disease without being able negatively to exclude every other.

From the purely diagnostic point of view I have arranged the following plan. It is one which I have unconsciously adopted in abdominal examinations, and I present it simply as being likely to be useful. It is, of course, a mere skeleton, indicating in a few words the most prominent and characteristic signs which suggest, but do not prove, the existence of the disease. Full diagnostic details will be found under the headings of the various diseases described.

The classification is based on the most prominent physical signs. The first question asked is, Is the tumour solid or fluid? The next question is, Is it in the middle line, or on one side? *i.e.*, Is it symmetrical or non-symmetrical, with regard to the general abdominal surface? If it is non-symmetrical, On which side does it lie? If it is symmetrical, Does it lie in the upper or lower abdomen, or in the middle? By answering these simple questions at each step in our examination, we narrow the limits of possible disease twofold, fourfold, and eightfold, at the first second, and third steps respectively.

Schematic Arrangement of Abdominal Tumours for Purposes of Diagnosis.

SOLID TUMOURS.

SYMMETRICAL.

Upper Abdomen.—Cancer of Pancreas. Cancer of Pylorus. Fibroid Thickening of Pylorus. Morbid Growths in Stomach.

Lower Abdomen.—Solid Growths of Ovary—Sarcoma, Fibroma, Carcinoma. Uterine Myoma. Sarcoma of Uterus. Molar Pregnancy. Extra-uterine Pregnancy (also fluid).

NON-SYMMETRICAL.

Either Side of Abdomen.—Solid Growths of Kidney—Sarcoma, Adenoma, Carcinoma. Displaced Kidney. Tumours of Colon.

Right Side.—Solid Growths of Liver—Sarcoma, Carcinoma. Solid Tumours of Gall-bladder. Cancer of Cæcum.

Left Side.—Enlargement of Spleen—Leucocythæmic, Amyloid, Cancerous, Syphilitic. Wandering Spleen.

INDIFFERENTLY SITUATED.

Solid Growths of Peritoneum—Cancer, Enchondroma. Cancer of Omentum. Cancer and Sarcoma of Parietes.

FLUID TUMOURS.

SYMMETRICAL.

Upper and Middle Abdomen.—Cysts of Pancreas. Peritoneal and Mesenteric Cysts. Encysted Dropsy of Peritoneum.

Lower Abdomen.—Ascites. Ovarian Cystoma. Parovarian Cysts. Papillomatous Cysts of Broad Ligament. Fibro-cysts of Uterus. Pregnancy. Hydramnios. Hæmatometra. Hæmatokolpos. Hydrometra. Extra-uterine Pregnancy. Cysts of Urachus.

NON-SYMMETRICAL.

Either Side.—Renal Cysts. Renal Hydatids. Hydro-nephrosis. Pyo-nephrosis. Nephric and Perinephric Abscess. Hydro-Hæmato-Pyo-salpinx. Extra-uterine Pregnancy. Ovarian Abscess.

Right Side.—Abscess of Liver. Hydatids of Liver. Dropsy and Empyema of Gall-bladder.

Left Side.—Abscess of Spleen. Hydatids of Spleen.

SOLID TUMOURS.

It is impossible to define the meaning of the clinical term "solidity" applied to tumours. Negatively, it has been taken as meaning "absence of fluctuation;" but this is inexact, for many fluid tumours do not fluctuate. And more than one class of tumour which is pathologically solid may give an obscure sense of fluctuation. It would be near the truth to say that most solid tumours are hard, that they communicate to the hand a peculiar sense of resistance, that none fluctuate freely, and that very few fluctuate even obscurely. But, undoubtedly, the best ultimate criterion of solidity and fluidity in tumours is the educated sense of touch. A skilled and experienced diagnostician will say almost at once, by laying his hand on a growth, whether it is solid or fluid; and such judgment, in my opinion, is more likely to be correct than the most painstaking enquiry into all the clinical features of the enlargement.

Solid Symmetrical Tumours.

By a symmetrical tumour is meant one which occupies equal parts of each side of the abdomen. The symmetry of the abdomen is not disturbed; the enlargement is bilaterally equal or nearly so.

SOLID SYMMETRICAL TUMOURS IN THE UPPER ABDOMEN.

Cancer of the Pancreas.

Cancer of the Pylorus.

Fibroid Thickening of the Pylorus.

Morbid Growths in the Stomach.

Cancer of the Pancreas.—A hard, rounded or irregular tumour fixed deeply in the region of the pancreas, usually covered by

bowel, and perhaps giving a sense of pulsation to palpation, with a vascular bruit on auscultation, is probably a pancreatic cancer. If the growth is small, nothing may be detected beyond a deep, obscure sense of resistance and hardness. It is not often that the growth acquires dimensions large enough to be visible through the abdominal wall.

Cancer of the Pylorus.—This may be felt as a small hard movable tumour situated in the epigastrium, usually a little to the right of the median line. It becomes fixed in its later stages. It always lies deeply, and is covered by bowel. Pressure causes pain.

Fibroid Thickening of the Pylorus.—Although thickening of the pylorus rarely reaches to the dimensions of a tumour, it sometimes becomes bulky enough to be obscurely felt as a localised induration. From the early stages of cancer of the pylorus, it cannot be diagnosed. The amount of pain elicited—small in thickening, considerable in cancer—may help the diagnosis.

Morbid Growths in the Stomach.—These are roughly median, but usually with the main enlargement on the left. They are usually one or other of the varieties of cancer, three-fourths of the cases being scirrhus. A growth in the stomach is at first freely movable, near the surface if in the anterior wall or greater curvature, rounded or irregular in outline, and may attain to a considerable size. On the posterior surface or lesser curvature (which is not a common situation), the growth may be only obscurely palpable when the stomach is empty. It tends to drag the stomach downwards, and from this cause, as well as from the dilatation of the viscus which usually accompanies it, may descend as low as the umbilicus. It is painful on palpation. I have seen two cases of cancer of the posterior wall, in each of which there was a visible protuberance in the epigastrium. Cancers of the stomach are late in becoming fixed; some slight degree of mobility is present to the last.

SOLID SYMMETRICAL TUMOURS IN THE LOWER ABDOMEN.

*Solid Growths of the Ovary.**Uterine Myoma.**Sarcoma of the Uterus.**Molar Pregnancy.**Extra-uterine Pregnancy.*

Solid Growths of the Ovary (sarcoma, fibroma, myoma, carcinoma) present clinical features which are, except where the tumours are of large size, essentially identical. When they first signify their presence, they are usually about the size of the fist, and have escaped from the pelvic into the abdominal cavity. Unless they are of considerable size, they are not strictly symmetrical, lying towards the side of the ovary from which they spring; but as they occupy more of the middle than of the sides of the abdomen, they may be considered as symmetrical. When large, they become strictly median.

Such tumours are round, hard, smooth on the surface and freely movable. They are not usually very painful on being handled. Vaginal examination reveals a normal uterus, sometimes dragged upwards, movable, and following upwards artificial elevation of the growth. By deep exploration with the fingers, it may be possible to make out tension and relaxation of the ovarian ligaments as the tumour is pulled upwards or pushed downwards. Palpation reveals the sensation that the uterus is not closely, but remotely attached to the tumour. This condition may be verified by passage of the uterine sound.

Uterine Myoma.—This enlargement varies in its appearance according as it is sessile or pedunculated, single or multiple, hard or soft ("œdematous"), fixed in the pelvis or free in the abdominal cavity. A single round pedunculated myoma may be very similar in clinical features to a solid ovarian tumour. It is more exactly median, and the uterus follows its movements more closely. The sessile myoma has more of its bulk low down than the pedunculated, and the uterus seems to be part of it, following its movements to the fullest extent. Multiple myomata exhibit

several rounded bosses irregularly placed in the lower abdomen, and are usually associated with considerable enlargement of the uterine tissues, with elongation of the uterine cavity. The distinctive signs of the individual varieties of myomata need not here be referred to. There is practically no limit, consistently with life, to the size to which these tumours may grow. Auscultation over myomatous growths may reveal a vascular bruit.

Sarcoma of the Uterus.—It is very seldom that sarcoma of the uterus, in itself a rare disease, attains to such a size as to become an abdominal tumour. Its growth is usually purely intra-uterine, and the uterine walls are spread over it. From a large fibroid polypus, it cannot be diagnosed with certainty: softness and rapidity of growth suggest sarcoma.

Molar Pregnancy.—This is recognised as being an intra-uterine enlargement by the ordinary methods of physical examination. The hydatidiform mole is said to reveal to palpation “a peculiar doughy boggy feeling, in the highest degree characteristic.” The abdominal tumour, which may increase more rapidly than a normal gestation, and grow to a greater size, is usually somewhat flattened. The principal signs in such cases are merely confirmatory of the more important general symptoms which accompany this form of abnormal gestation.

Extra-uterine Pregnancy.—When the fœtus is dead, and the surrounding fluids are absorbed, an extra-uterine pregnancy may appear as a hard, irregularly rounded mass fixed in the lower abdomen and pelvis. Its connections with the uterus, which is always enlarged, are close and firm. Here also history is all-important in forming a diagnosis. It may be impossible, so far as physical signs are concerned, to diagnose a uterine myoma from an extra-uterine pregnancy.

Solid Non-symmetrical Tumours.

By a non-symmetrical tumour is meant one which, visibly or palpably, lies chiefly in and has its main connections on

one side of the abdomen. The symmetry of the abdomen, if there is evident enlargement, is disturbed. If there is no enlargement, an abnormal swelling is felt in one side of the cavity.

SOLID NON-SYMMETRICAL TUMOURS FOUND ON EITHER SIDE
OF THE ABDOMEN.

Solid Growths of the Kidney.

Displaced Kidney, movable and fixed.

Tumours of the Colon.

Solid Growths of the Kidney.—These are: sarcoma, several varieties; adenoma; and carcinoma. Clinically, certain suppurative lesions of the kidney may be solid. From mere increase of resistance in the loin without visible enlargement, to a bulk so great that it may pass the middle line and even fill the whole abdominal cavity, there is every gradation of size in renal tumours. Generally speaking, a hard smooth body, fixed or but slightly movable, in either loin, dull on percussion from the lumbar regions forwards, and completely filling the costo-iliac space, will indicate a solid renal growth. Pressure on a renal tumour from the front gives a peculiar sense of hard, unyielding resistance. In tumours of considerable size, the passage of the colon—ascending or descending, as the case may be—over its surface may be detected by percussion or palpation.

Displaced Kidney, movable and fixed.—A movable and a floating kidney, pathologically distinct, give identical physical signs. A body of the size, shape, and consistence of the kidney is felt somewhere in the abdomen between its normal situation and the middle line: it glides from under the palpating fingers, and may be replaced in the loin, when its presence may be detected by bimanual palpation. It is always covered by bowel. A peculiar sensation of nausea and faintness is produced by pressure. Movable kidney is most common on the right side.

A kidney fixed in an abnormal situation is usually found near the brim of the pelvis, close to the sacro-iliac joint. It is usually larger and more lobulated than natural, but otherwise presents to

the examining finger the physical characters of renal substance. Fixed malposition of the kidney is most frequently met with on the left side. Manual exploration by the rectum may, in certain cases, be necessary for diagnosis.

Tumours of the Colon.—Solid growths of the colon are—polypus, adenoma or adeno-sarcoma, and cancer. A polypoid growth is usually found in the descending colon; it is rarely so large as an orange, and is freely movable for some inches in all directions. It lies usually at or near the surface of the abdomen. In the sigmoid flexure it is perceptible on rectal palpation. Cancer may be found in any part of the large bowel. It is felt rather as an obscure thickening than as a distinct rounded tumour, and except in the transverse colon, is slightly or not at all movable. For diagnosis, other signs, especially those found in the excreta, are essential.

SOLID NON-SYMMETRICAL GROWTHS ON THE RIGHT SIDE
OF THE ABDOMEN.

Solid Growths of the Liver.

Solid Tumour of the Gall-bladder.

Cancer of the Cecum.

Solid Growths of the Liver.—Various kinds of cancer and sarcoma are found affecting the liver, as new growths; it may be enlarged from fatty or lardaceous disease, or other influences which do not here concern us. The leading physical signs in malignant disease are, a solid resisting enlargement in the hepatic region—most frequently in the right lobe, rarely in the left lobe—causing more of its surface than is natural to protrude from under the ribs, and increasing the area of dulness. From the upper limits of hepatic dulness over the ribs to the lower limits of the enlargement in the abdomen, dulness on percussion is continuous. If the enlargement is not very great, and if the growth is not adherent, the liver moves upwards and downwards during respiration. The characteristic knobs on the surface of the liver in cancer are almost pathognomonic. The edge of the liver may be palpated. There is practically no limit, other than the capacity

of the abdomen, to the growth of malignant tumours of the liver.

Solid Tumour of the Gall-bladder.—Except as part of general malignant disease of the liver, new growths in the gall-bladder are rare. A gall-bladder full of gall-stones, and with walls thickened from inflammation, is, clinically, a solid tumour. A tumour of the gall-bladder appears in its normal situation at the edge of the liver, and grows diagonally downwards and inwards towards the umbilicus. It is smooth and rounded on the surface, globular, ovoid, or pear-shaped in outline, and is movable in lateral directions, and to some extent backwards. Dulness over it is rarely absolute; an area of resonance, from the presence of intestine, is occasionally found separating it from the liver margin.

Cancer of the Cæcum.—A hard irregular tumour, not of large size, in the right iliac fossa, and movable through a limited area, may be a malignant growth in the cæcum. Other signs, relating chiefly to obstruction to the passage of the intestinal contents, are necessary to the diagnosis. Inflammation originating in the vermiform appendix, may be associated with the development of an enlargement which simulates new growth: in this case the enlargement is not movable. A malignant tumour in this part of the bowel is not usually strictly limited to the cæcum, but involves either ileum or ascending colon.

SOLID NON-SYMMETRICAL GROWTHS ON THE LEFT SIDE OF
THE ABDOMEN.

Solid Enlargements of the Spleen.
Wandering Spleen.

Solid Enlargements of the Spleen.—With the diagnosis of the acute enlargements of the spleen found in various purely medical diseases we are not here concerned. The varieties of splenic enlargement likely to be met with in exploration of the abdomen for tumours arise from Leucocythæmia, Amyloid degeneration, Cancer, and Syphilis. In all of these, physical examination reveals little more than enlargement of the organ. Splenic

tumours appear under the left false ribs, and grow downwards and inwards towards the middle line. They lie close to the parietes, and give an absolutely dull note on percussion over the surface; there is usually an area of resonance in the loin behind. The characteristic notched or festooned inner border is usually to be felt. Unless the tumour is of considerable size—and splenic tumours may attain to great dimensions—it enjoys some degree of mobility. Palpation in most cases is painless.

Wandering Spleen.—This rare condition is found exclusively in women. A displaced spleen has been found at the umbilicus, in the true pelvis, and at various other situations in the left abdomen. In one case, at least, it has been found free in the cavity, the pedicle having been twisted through. Absence of dulness at the normal site of the spleen, and the presence of a body having the physical characters of this organ, movable round a centre placed under the left false ribs, is probably wandering spleen. A dislocated spleen is, however, liable to contract adhesions in its abnormal position, and then mobility is absent.

SOLID TUMOURS INDIFFERENTLY SITUATED IN THE ABDOMINAL CAVITY.

Solid Growths of the Peritoneum.

Solid Growths of the Omentum.

Solid Growths of the Abdominal Parietes.

Tumours of the omentum, the peritoneum, the small intestines, and the parietes, may appear at any part of the abdominal area. Their situation is indifferently lateral or median, high up or low down.

Solid Growths of the Peritoneum—Excluding tubercular disease, the new developments met with, in connection with the peritoneum, are practically all malignant. Enchondroma has been found as a new growth, originating from the peritoneum. In the great majority of cases, peritoneal cancer is secondary either to out-lying disease or to local disease in the intestines. As usually met with, cancer of the peritoneum is sessile, very hard and irregular

on the surface, and accompanied by a variable amount of ascitic fluid. If originating from the bowel, and seen early, it may be movable; but it very soon becomes fixed, by implication of neighbouring organs. In most cases bowel either overlies it or passes through it, and thus gives a percussion note of resonance or modified dulness. In cases of advanced disease, a large amount of ascitic fluid may be present, masking the signs and obscuring the diagnosis.

Solid growths of the small intestine not involving the peritoneum are mere pathological curiosities, and may be practically ignored.

Solid Growths of the Omentum.—Various forms of malignant disease may attack the omentum; colloid cancer is the most important. It is known by its superficial position, overlying the bowels; by its very irregular surface, hard at most parts, but boggy or even semi-fluctuating where colloid material abounds; and by the wide superficies which it occupies as compared with its general bulk. Ascites, revealed by the ordinary signs, may be present behind the growth. In the earliest stages of omental cancer, palpation and deep percussion may elicit signs that it overlies, and is supported by, intestines.

Solid Growths of the Abdominal Parietes.—These are usually malignant, most frequently cancerous, but sometimes sarcomatous. They cause bulgings of the parietes, more prominent than their size would seem to warrant; are rounded, and not very irregular on the surface; they follow closely the movements of the abdominal walls, and, if of moderate size, appear to float on the surface of the intestines. There is absolute dulness all over the palpable surface.

FLUID TUMOURS

The only definite attribute that can be attached to the clinical term "fluidity," as applied to new growths, is "presence of fluctuation." Many tumours, however, that have fluid contents, and that are diagnosed as having such, do not exhibit the sign of fluctuation. Between the definite physical signs of

fluidity and solidity there are gradations which we seek to describe by such terms as "soft," "boggy," "semi-fluctuating." But the actual condition, solid or fluid, is in many instances a thing to be decided simply and solely by the educated sense of touch. So many circumstances combine to obscure or abolish the sign of fluctuation, even when it ought to be present, that special pains should be taken to perfect our means of diagnosis without this sign. Thick abdominal walls, tension or thickness in the cyst-wall, great density of the fluid, or multiplicity of the loculi in which the fluid is contained, are some of the hindrances to fluctuation. We conclude, therefore, that while the positive sign—fluctuation—is proof of fluidity, its absence is not proof to the contrary; and that, though no verbal description of it is possible, the educated sense of touch must frequently be our sole guide.

FLUID SYMMETRICAL TUMOURS IN THE UPPER AND MIDDLE
ABDOMEN.

Cysts of the Pancreas.

*Peritoneal and Mesenteric Cysts. Encysted Dropsy of the
Peritoneum.*

Cysts of the Pancreas.—Though not always accurately symmetrical, cysts of the pancreas lie mainly in the middle line. A rounded, thin-walled cyst, distinctly fluctuating, deeply and firmly fixed, not moving with respiration, and situated above the umbilicus, may be a pancreatic cyst. Exploratory puncture reveals a fluid, viscid or opalescent, alkaline in reaction, and containing a considerable amount of albumen, which is coagulated by heat and by nitric acid.

Peritoneal and Mesenteric Cysts. Encysted Dropsy of the Peritoneum.—Like pancreatic cysts, these, though chiefly occupying the middle line, are rarely exactly median. It is impossible to diagnose them with precision. They clearly contain fluid, though fluctuation is usually obscure; it is rarely possible to make out a distinctly outlined cyst-wall, as intestine is frequently intimately attached to its surface, and the percussion notes are liable to

vary at different times of examination. Some degree of mobility is usually present. Such collections are usually situated either at the level of, or below, the umbilicus; occasionally, however, they are found elsewhere.

FLUID SYMMETRICAL ENLARGEMENTS IN THE LOWER ABDOMEN.

Ascites. Peritoneal Dropsy. Hydroperitoneum.

Ovarian Cystoma.

Parovarian Cyst.

Papillomatous Cysts of the Broad Ligament.

Fibro-cystic Disease of the Uterus.

Pregnancy.

Hydramnios. Dropsy of the Amnion.

Hæmatokolpos.

Hydrometra.

Extra-uterine Pregnancy.

Cysts of the Urachus.

Ascites. Peritoneal Dropsy. Hydroperitoneum.—A fluctuating fluid collection in the abdominal cavity that changes position with the movements of the patient, always gravitating to the lowest part of the cavity and causing dulness on percussion there, but leaving resonant the highest part, or situations from which bowel cannot be displaced, is probably ascites. In the supine position, there is dulness in the flanks; and if the amount of fluid is not very great, there is resonance in front, over a circular or crescentic area the concavity of which is towards the chest. (Fig. 4.) If the parietes are not greatly distended, the abdomen is flattened; if its walls are lax, there may be bulging in the flanks. In cases of great distension, the umbilicus protrudes. Vaginal examination will, if the patient's body is raised, reveal the presence of even small quantities of fluid in Douglas's pouch. With middle finger in rectum and forefinger in vagina, the characteristic feeling of fluid distending the pouch may be more easily made out. In men gravitation of fluid into the lower abdomen must be diagnosed by rectal examination alone, and is not so satisfactory.

Ovarian Cystoma.—A rounded or irregular tumour in the middle line, or slightly to one side, always showing its presence in front to palpation or percussion, never changing its shape, and movable only in mass or not at all, may be an ovarian cyst. In the supine posture there is a circular area of dulness, surrounded by a "tympanic corona"; if no ascites is present, there is resonance in the flanks. (Fig. 5.) There is no protrusion of



FIG. 4.



FIG. 5.

Diagrams showing development of areas of dulness in ascites (Fig. 4), and in ovarian tumour (Fig. 5). Darker shading indicates an earlier stage of disease.

the umbilicus. Vaginal examination reveals close or remote connection with the uterus, with displacement, and sometimes enlargement, of that organ.

Parovarian Cyst.—This variety of growth has the character of the preceding, as to dulness in front and resonance in the flanks. The cyst is thin-walled, and fluctuation is very evident. By the vagina it may frequently be palpated, when its thin wall and connection with the uterus through the broad ligament will confirm the diagnosis.

Papillomatous Cysts of the Broad Ligament.—These are not usually diagnosed from ovarian cystomata. They are firmly

fixed low down in the pelvis, and are frequently closely incorporated with the uterus. One or more large cysts, not often symmetrical, and with sulci between them, occupy the abdomen; by vaginal examination, several cysts of smaller size may be detected in the pelvis. Small growths of this nature are one-sided.

Fibro-cystic Disease of the Uterus.—It is probable that ovarian or broad ligament cysts have not been infrequently described as cystic disease of the uterus. True cystic disease is undoubtedly very rare. In very few cases can it be diagnosed from ovarian cystoma. It has most of the signs of the latter, and is always sessile on the uterus, moving consentaneously with that organ. Many ovarian tumours are very intimately attached to the uterus.

Pregnancy.—A pregnant uterus stands out from the pelvis more prominently than an ovarian or other tumour of the same size: more of the fundus is palpable than in other tumours. The uterine walls are of a peculiar density, fluctuation is obscure, and the foetus may be felt by palpation or ballottement. By the vagina, there is detected a characteristic softening of the cervix—not merely the superficial softening of swollen mucous membrane, but a softening all through its tissue, extending up to the globular capsule of muscular fibre which contains the foetus. The lower portions of the uterus move in harmony with the fundus. The other well-known signs of pregnancy will, of course, be looked for.

Hydramnios. Dropsy of the Amnion.—In pregnancy complicated with albuminuria the amniotic fluid may be in excess, giving rise to a condition which may be not unlike ovarian or parovarian cyst. The uterine walls are very thin, and fluctuation may readily be elicited, while the foetus may be beyond the reach of palpation. Special weight is to be given to the condition of the cervix—softened, as in ordinary pregnancy,—and to the other evidences of gestation.

Hæmatokolpos. Retained Menses.—The various conditions in the vagina or hymen which prevent the outflow of the menstrual fluid at puberty may cause the appearance of a cystic tumour

in the lower abdomen. The ordinary sign of a fluid encysted enlargement, with the abnormality easily discovered by vaginal examination, in addition to amenorrhœa, will make the diagnosis easy. Hæmatokolpos bulges more into the pelvis than hæmatometra; it may even cause distension of the perineum, and visibly protrude through the vulva. The uterus, sessile on the top of the cyst, may sometimes be palpated through the abdomen.

Hydrometra.—When occlusion of the cervical canal at its external or internal opening takes place after the menopause, there is a collection of fluid in the uterus that is not blood, but a clear or blood-stained watery or viscid fluid. The uterine walls are much attenuated, and fluctuation is well marked. As a clinical curiosity, an hour-glass dilatation of the uterus, from occlusion of the internal as well as the external os, may be mentioned. Such collections of watery fluid inside the uterus do not usually attain to large size, and they are of very slow growth. If, as very rarely happens, the contents suppurate, we get the condition called *pyometra*.

Extra-uterine Pregnancy.—While the foetus is still alive, and the fluids are in normal amount, an extra-uterine gestation may appear in the lower abdomen as a thin-walled obscurely fluctuating cyst, with firm and deep connections in the pelvis. By the vagina, an enlarged and probably anteverted uterus, intimately connected with the growth, will be detected. General matting and induration in Douglas's pouch, and, very likely, part of the contour of a foetus, may be felt. The signs of pregnancy, modified and misleading, will be present.

Cysts of the Urachus.—Small cysts of the urachus containing a few drachms of fluid are sometimes found at abdominal operations. Large cysts are rare. They are exactly median, rise a little higher than ovarian tumours of the same size, have no connection with the uterus, and, if not large, may leave a resonant area between the lower margins and the pubes. They fluctuate freely in all directions. Sometimes there is a history of urinary trouble.

FLUID NON-SYMMETRICAL TUMOURS FOUND ON EITHER SIDE OF
THE ABDOMEN.

Fluid Enlargements connected with the Kidneys.

Nephric and Peri-nephric Abscess.

Fluid collections in the Fallopian Tubes.

Extra-uterine Pregnancy.

Ovarian Abscess.

Fluid Enlargements connected with the Kidney.—These are :

Renal cysts,

Hydatids,

Hydro-nephrosis,

Pyo-nephrosis.

The special diagnosis of these conditions must be carried out by methods other than the purely physical. Certain physical signs which they have in common may here be enumerated. A cystic enlargement of the kidney lies in close contact with the parietes in the lumbar region, causing absolute dulness there and, according to its size, over the anterior surface; and is either fixed or but slightly movable, having its main attachment deep in the loin. Growing from the side towards the middle line, as well as upwards and downwards, it may occupy the whole abdominal cavity. But it nearly always leaves resonance in the opposite flank, and can rarely be detected by vaginal palpation. The passage of colon over it may be revealed by percussion and palpation.

Nephric and Peri-nephric Abscess.—A collection of fluid in the region of the kidney, associated with signs of suppuration, may be abscess in the organ itself or in the outlying tissues. It is not always possible to differentiate the two conditions; in fact, they are often associated. In cases of any standing there is discolouration of the overlying skin, with inflammatory thickening in the deep parts, and tenderness on pressure. The lumbar muscles are fixed, tense and brawny. Positive signs of fluid are frequently absent; in most cases the early condition of renal suppuration is that of a solid, and not of a fluid, enlargement.

Fluid Collections in the Fallopian Tubes.—These are:—

Hydro-salpinx,
Hæmato-salpinx,
Pyo-salpinx.

It is not often that cystic enlargements of the Fallopian tubes become abdominal tumours. They are usually confined to the pelvis, and discovered by vaginal and rectal palpation, or by the ordinary bimanual method. An ovoid or irregular fluid collection of small size lying in the recto-uterine space, and usually on one side of it, may be a cystic dilatation of the Fallopian tube. It is evidently closely connected with one side of the uterus at the fundus. If painless, it is possibly hydro-salpinx; but this cannot be differentiated from small cysts of the ovary. If painful on palpation—and pain is often a very prominent symptom—it is probably pyo- or hæmato-salpinx; but may be ovarian abscess, or localised pelvic suppuration, either primary or resulting from pelvic hæmatocele. The diagnosis of lesions of the Fallopian tubes is attended with considerable difficulty.

Extra-uterine Pregnancy, and especially Fallopian pregnancy (which all these cases probably are), is in its early stages, unilateral, and is obscurely cystic. When rupture takes place, the enlargement is chiefly median.

Ovarian Abscess.—A suppurating ovary is usually dislocated downwards. It is rarely larger than a hen's egg, very tender on pressure, tense and obscurely fluctuating. It usually lies in the recto-uterine pouch, on one side or the other, and cannot, on account of adhesions, be moved from this situation.

FLUID NON-SYMMETRICAL TUMOURS ON THE RIGHT SIDE OF THE ABDOMEN.

Abscess of the Liver.

Hydatid Disease of the Liver.

Distension of the Gall-bladder.

Abscess of the Liver.—Only in its later stages can the presence of fluid in a hepatic abscess be detected by palpation. There

is general enlargement of the area of hepatic dulness; the liver margin can be palpated under the ribs, and pressure there causes pain; there are the usual signs, not always well marked, however, of suppuration; and in advanced cases, where the growth of the abscess is mainly downwards, there may be a palpable and visible protrusion of the parietes. Exploratory puncture reveals the presence of pus.

Hydatid Disease of the Liver.—A hydatid cyst usually appears as a smooth, painless, globular enlargement in the right hypochondriac or epigastric regions, obscurely fluctuating, elastic and resisting. The characteristic hydatid fremitus is not always detected. If the cyst lies deep in the hepatic tissue, or on its posterior aspect, it produces no signs other than hepatic enlargement. Exploratory puncture reveals the existence of clear hydatid fluid, perhaps with portions of the entozoa. Hydatid cysts sometimes suppurate, and then are indistinguishable from abscess.

Distension of the Gall-bladder.—A pyriform or ovoid cystic swelling in the right hypochondrium, fixed under the liver, but movable elsewhere, painless, or but slightly painful, will probably be distended gall-bladder. The exact nature of its contents—watery, or purulent, or bilious—will be revealed by the consideration of accessory symptoms.

FLUID NON-SYMMETRICAL ENLARGEMENTS ON THE LEFT SIDE OF
THE ABDOMEN.

Splenic Abscess.

Hydatids of the Spleen.

Splenic Abscess.—Abscess of the spleen is of rare occurrence; and, unless it is of large size, and shows a tendency to burst through the parietes, it is not often diagnosed. Fluctuation is always obscure, often unrecognisable. Though the symptoms are usually acute and attended with pain, they are sometimes very chronic, and little more may appear in evidence of splenic abscess than a boggy semi-elastic tumour in the left hypo-

chondrium. I have seen a case, in the practice of a colleague, where a large abscess of the spleen was opened and a piece of sloughed splenic tissue removed, nearly as large as an orange, which showed slight and unimportant signs of its presence.

Hydatids of the Spleen.—This condition is also rare. A painless tumour in the region of the spleen, smooth on the surface, but sometimes lobulated, obscurely fluctuating or only boggy, painless, and perhaps exhibiting the hydatid trembling, is probably hydatid cyst of the spleen. Exploratory puncture renders the diagnosis certain.

Artificial Distension of the Stomach and Intestines as an aid to Diagnosis.

Distension of the stomach and the intestines by gas and by fluids has recently been advocated and employed in the diagnosis of abdominal diseases and injuries. Senn of Milwaukee has successfully employed rectal and stomachic inflation of hydrogen gas for the purpose of diagnosing perforation of the viscera, and others have followed his example. This will be again referred to. In 1883 Ziemmsen used inflation of the rectum with carbonic acid gas as an aid to diagnosis, and spoke highly of the plan, but it did not come into extensive use. More recently Minkowski* has made an elaborate study of the practice in aiding the diagnosis of abdominal tumours, having employed it in no fewer than 110 cases. He distended the stomach with carbonic acid gas generated by the administration of bicarbonate of soda and tartaric acid; water was employed for distending the rectum. A comparison of the position and relations of the tumour before and after distension reveals certain facts which may be of importance. Tumours of the liver, gall-bladder, and spleen are displaced or more distinctly outlined after gaseous distension of the stomach. The diagnosis of tumours of the large intestine, mesentery, kidney, and pancreas is said to be assisted by fluid

* *Berl. Klin. Woch.*, No. 31, 1888.

injections into the large intestine. The inferences as to changes in position or variations in dulness are to be made from known anatomical relations, and need not here be enlarged upon.

As a routine method of aiding in the diagnosis of abdominal tumours, artificial distension of the hollow viscera has not found much favour in this country. In the great majority of cases it is superfluous; in such cases, its employment is barbarous in the same sense that it is barbarous to seek to elicit crepitus in a case of fracture where other symptoms suffice for diagnosis. In many cases it is inadmissible; the condition of the patient forbids the deliberate infliction of pain, or even discomfort, for a possible but doubtful help in diagnosis. Where the patient's condition admits of it, where diagnosis is incomplete, and is likely to be made more complete by the proceeding, we may, if it is important that the diagnosis be made, employ it.

The Shape of the Abdomen.

Clinical Examples in Diagnosis.—In concrete illustration of a few of the leading-varieties of abdominal enlargement, I venture to introduce process reproductions of photographs of coloured life-size models which I have made for teaching purposes. In front of each variety of enlargement the normal abdominal parietes are shown in faint outlines, so that the nature and degree of departure from normal in shape and thickness of parietes can be seen at a glance. The section is near the level of the middle of the fourth lumbar vertebra, and the upper surface of the section is shown.

In fig. 6 a section through an abdomen containing an ovarian tumour is represented. The shape of the abdomen is not quite symmetrical, and it tends to be conical or pointed. There is no bulging of flanks. The tumour is in contact with the parietes everywhere in front, and rests on the spine or promontory of the sacrum with the patient supine. Where the tumour touches the parietes there is dulness on percussion; that is, everywhere save in the flanks, into which the intestines are crowded, and where

there is resonance. The gas-containing intestines rise further forward on the right side than on the left: this is an accident depending on the position and shape of the tumour. The parietes are thinned, particularly in front.

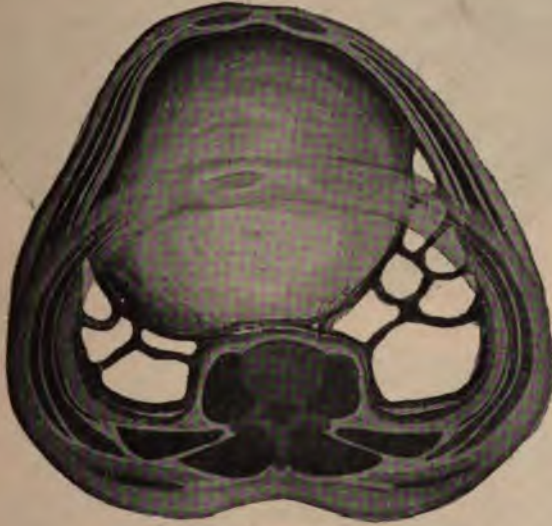


FIG. 6.
Ovarian Tumour.
(See Text.)

Fig. 7 is intended to represent an abdomen moderately distended with ascites. The shape of the abdomen is symmetrical and flattened. The flanks bulge. The intestines, containing gas, float on the fluid, rise to the surface, and are on percussion resonant. The colon, ascending and descending, is confined by the mesocolon, and cannot rise to the surface. The ascending colon is shown somewhat distended; if near to the surface, and fully distended with gas, a resonant note on percussion in the flank might be educed. As a rule, however, there is dulness from the fluid gravitating into the flanks. The parietes are generally and evenly thinned.

Fig. 8 is intended to represent an abdominal section of intestinal obstruction. The shape of the abdomen is globular and



FIG. 7.

Ascites.

(See Text.)



FIG. 8.

Intestinal Obstruction.

(See Text.)

symmetrical, and it does not bulge in the flanks. In front are enormously distended intestines: here there would be clear resonance on percussion. Behind and in the flanks the intestines, also distended, contain some fluid, and this may give a modified resonance or actual dulness. The most distended intestines tend to rise to the surface, and the fluid-laden bowels to fall to the depths of the cavity; but exceptions to this rule are frequent when the cause of obstruction also fixes the obstructed gut at some point near the surface. The parietes are not markedly thinned except in chronic cases, when also dulness in the flanks from the presence of fluid-laden bowels is likely to be more marked.

Fig. 9 is intended to show a section through a localised

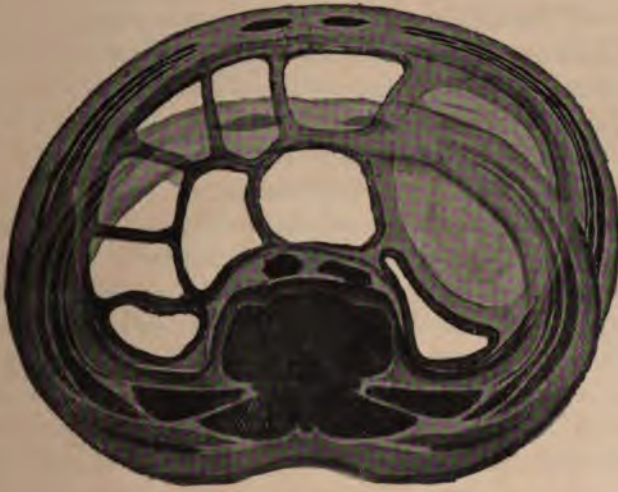


FIG. 9.

Appendicular Abscess.

(See Text.)

collection of pus, such as is found in circumscribed abscess connected with appendicitis. The abdomen is not quite symmetrical, the enlargement being most marked to the front of the

collection of pus. Between the abscess and the contiguous intestines, and between the intestines themselves, a thick layer of lymph is seen; the bowels in contact with the abscess are distended to the utmost; elsewhere they are distended, but not to an extreme extent. The ascending colon is distended, but flattened by pressure of the abscess. Resonance is absent in front on the right side; it may be present in modified degree in the flank; it is clear everywhere else. The parietes are not thinned to any marked extent.

General Examination of the Patient.

What has been said refers merely to the diagnosis of the growth or disease for which operation is contemplated. But before such operation is decided upon, we must also make an investigation of every vital organ—diagnose the condition of the patient, in fact. The importance of this cannot be too strongly insisted upon. Many of the catastrophes of abdominal surgery are to be attributed to overlooking some lesion of an important organ, such as an exhaustive and skilful investigation of the whole of the system might have detected. The grand fact of the diagnosis of the tumour, and everything connected with it, is too apt to overshadow the diagnosis of other things. We take a pride, and justly, in the rapidity and accuracy with which we can diagnose the nature and connections of an abdominal tumour; and this cultured and impressive skill is liable to make us impatient of the tedious medical examination of the whole system. The condition of the heart, lungs, kidneys, no one would dare to overlook who was not recklessly foolish; but any abnormal symptom, however apparently trivial, ought to be followed up to its origin. For instance, in two cases of abdominal tumour, I had seen bleeding from the rectum, as an effect of pressure, which disappeared when the growth was removed. A third case had similar bleeding, but for certain reasons was not at once submitted to operation. Later on, the

continuance of the bleeding demanded a special examination, and revealed cancer of the rectum. Had I operated upon this patient when she was first seen, I should have done so in ignorance of this condition. Dr. Henry C. Coe* records a case which he lost from having overlooked a stricture of the colon; and many other similar cases could be quoted. Therefore, we ought never lightly to pass over a symptom that *might* be caused by the disease: we ought to be certain before operating that the symptom *is* so caused.

Exploratory Incision.

There is no doubt that a good deal of rashness and a certain amount of incompetence is sought to be concealed by the practice of "exploratory incisions." No incision ought to be merely exploratory: at the utmost it ought to be ultimately diagnostic in a case of extreme doubt and difficulty. The exploratory incision of the skilled surgeon is widely different from that of the tyro. Where the former will make a correct diagnosis in ninety-nine out of a hundred cases, the latter will fail over his tenth case; but he may not conclude that the justification of exploratory operation is assured merely because he is in doubt in this case. Perhaps surgeons of large experience are somewhat to blame for so freely speaking of this tentative proceeding as being frequently justifiable and necessary. What is justifiable in their experienced hands, may not be so in the hands of less experienced men. Before submitting our patient to what, after all, is a serious operation and a trying illness, we ought again and again to return to the examination of the disease, read and re-read the exhaustive history, and decide only after having done this. At different examinations the mind focuses its attention on different points, and travels in different directions; and each examination may give us new information. The help of a skilled friend is always valuable, but too much weight must not be given to it. Responsibility begets trustworthiness: the man who operates is

* *N. Y. Med. Journ.*, May 9th, 1885.

the man who must diagnose, and additional acumen is given to his powers by the heavy responsibility that waits upon their fruition.

Having made this "exploratory incision," we must not be too rash in converting it into an operative one. We ought to be sure, before inflicting the slightest injury upon the growth, that we can remove it. To have been forced to submit the patient to exploration by incision, is grievous enough; but to have added thereto additional risks from sheer meddlesomeness, is unpardonable. Difficulties and dangers, legitimate and unavoidable, are numerous enough, in all conscience, in abdominal surgery: let us not to these add risks that are illegitimate and avoidable.

SECTION II.

ABDOMINAL OPERATIONS CONSIDERED GENERALLY.

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ABDOMINAL OPERATIONS CONSIDERED GENERALLY.

Nomenclature. Historical.

The operation of opening the abdominal cavity has for a very long time been known by the term *Gastrotomy*, from *γαστήρ*—belly, and *τομή*—incision. As the proceeding was at first carried out only for the purpose of removing a *fœtus* from the womb, the name came to have a limited application to *Cæsarean* section. Thus, in the dictionary by *Blancard* of *Middleburg*, in *Zealand*, published near the end of the seventeenth century, and translated into English in 1702, "*Gastrotomia*" is defined as "the cutting open of the abdomen and womb, as in *sectio Cæsarea*." *Gastro-rhaphy* about this time was chiefly used as meaning simple suture of wounds in the abdomen; but it was also applied to the introduction of sutures in the bowel. In these instances the word *γαστήρ* was used in its original and legitimate sense, corresponding to the vulgar rather than the anatomical word "stomach;" but when the stomach proper came within the sphere of practical

surgery, Gastrotomy was often used for the operation of removal of foreign bodies from that viscus. Sédillot introduced the word Gastrotomy (στόμα—mouth) to indicate the formation of stomachic fistula; and Gastrorraphy has more recently been used by Billroth and others to signify closure of an opening in the stomach by suture. In the beginning of this century the term Laparotomy (λαπάρα—flank) came into use for operations such as herniotomy, or the operation for artificial anus made in the loin. Some one of the moderns unfortunately stumbled on the old name, and a well-meaning but misplaced love for it led to its being used for any and every operation in which incision through the abdominal wall is performed. The employment of "Laparotomy" in this sense ought to be abandoned, not only because it is wrong, but also because we have room for the word in its proper and legitimate meaning. Petit* would limit the word Gastrotomy to indicate in a general way the operations practised on the abdominal wall; Laparotomy, for the operations performed for intestinal obstruction; and Stomachic Incision (Taille stomacale), for removal of foreign bodies from the stomach. The term "Abdominal section" so generally in use is perhaps the most objectionable of all. An abdominal section is made on a frozen cadaver with a saw, for anatomical purposes; it is not easy to understand how an evil chance led to the name being given to an incision made through part of the abdominal wall for surgical purposes.

We have now, thanks to Harris of Philadelphia, got a word which fully expresses the meaning to be conveyed and which is classically correct. This word is "Cœliotomy" (κοιλία—belly, and τομή—incision), and it will be used throughout this work as meaning any incision made through the abdominal parietes for whatever purpose performed, and in whatever position situated.

The special operation is sought to be indicated by affixing certain terminal words to the Greek name of the organ indicated. Thus, "-tomy" (τομή—incision) is added to indicate mere incision, as in nephrotomy, hepatotomy, cholecystotomy. The termination "-ectomy" (ἐκ, out of; τομή) is added to indicate cutting out or removing the organ; as in nephrectomy, splenectomy, colectomy,

* *Dict. Encycl. des Sc. Méd.*, tome VII., 1881, art. "Gastrotomie."

pylorectomy, &c. The suffix “-stomy” (*στόμα*—mouth) indicates the formation of an opening in a hollow viscus that is intended to be permanent, as in gastrostomy, gastro-enterostomy. In colotomy, an opening is made that is usually permanent, and the word colostomy would then be more exact; enterotomy would sometimes, but not always, be better indicated by the word enterostomy. The termination “-rraphy” or “-rhaphy” (*ῥαφή*—suture) is used as meaning any suturing of an organ for wound, as gastrorrhaphy; or to fix it, if movable, as nephorrhaphy. The latter term would more properly be used to indicate the suturing of a wound or laceration of the kidney: for fixation of the kidney, such a word as nephropexy (*πῆγνυμι*—fix) is more suitable. This suffix “-pexy,” meaning “fixation,” which I suggested in an early edition of this work, is now in general use; and nephropexy, hysteropexy, and such words generally replace nephorrhaphy, hysterorrhaphy, where fixation of the organ is meant.

Compound words may conveniently be employed to indicate various methods of proceeding: thus, *cœlio-nephrectomy* would be used for removal of the kidney by abdominal section; *lumbo-nephrectomy*, for removal of the kidney through the loin. Again, *cœlio-hysterotomy* would technically name Cæsarean section; and *cœlio-hysterectomy*, Porro's operation; while *colpo-hysterectomy* would indicate removal of the uterus through the vagina, as for cancer.

As far as is possible and proper, accurate scientific naming of the various operations will be adopted: for some operations, the names, though unsuitable in strict nomenclature, are so well known and so generally used that it would be unwise to seek to displace them. Accurate science demands accurate naming. It is, perhaps, unfortunate that much of our nomenclature is ponderous. But names that aim at being definitions must often be ponderous; a name that is short, and at the same time meaningless or misleading, is not to be preferred to a name that carries its meaning on the face of it even if it is long.

The history of each operation will be given in its proper place. Here it need only be noted that the progress of abdominal surgery has not been simply forward in a straight line, but in waves of

advancement and retrogression. There can be no doubt that the technique of abdominal surgery was more perfect nearly two centuries ago than it was fifty years ago. Minute and excellent directions for making and for suturing wounds in the abdominal walls were given in several works on surgery published during the seventeenth and eighteenth centuries. In more than one of the works of this period instructions as to the inclusion of the peritoneum in suturing the abdomen are given with scientific precision. Heister, who wrote about the middle of the eighteenth century, so far anticipated modern art as to advocate drainage of the lower abdomen by a cannula, and washing out by "vulnerable decoctions." In Cæsarean section, Roussetus advised this, as well as drainage of the uterus by a cannula inserted into its cavity. The directions given for closing an abdominal wound by Dionis, in his *Course of Surgical Operations* (1733), might almost be quoted bodily as the practice of the Samaritan Free Hospital to-day.

All this good work was ignored, and more which followed; and, in times comparatively modern, much good practice that had been tried and proved by past masters in the art was neglected and overlooked. The clamp in ovariectomy was a distinct step backward; but the amount of advance which followed its abolition, being synchronous with the introduction of antiseptics, cannot accurately be estimated. I think there can be no doubt that the most important single contribution to abdominal surgery is the gospel of surgical cleanliness preached by Lister; but along with this we must reckon the greater perfection of finish in every operation, rendering the work of the best operators something approaching the ideal in surgical art.

The Operative Surgery of the Abdomen.

Environment of Patient.

Preliminaries to Operation.

Surgical Armamentarium.

The Operation itself.

Surgery of the Parietes.

Intra-Abdominal Manipulations.

Drainage.

The practical surgery of the abdomen presents many features special to itself. The manipulations have to be performed in an area exquisitely sensitive to traumatic influences, and in the midst of organs whose integrity is peculiarly necessary to life. The peritoneal fluids are very prone to take on septic contamination, and the inflammation thereby induced is doubly dangerous, from the great amount of surface over which it may extend, and from the involvement of the structures of the sympathetic system, which are so abundantly distributed under the peritoneal membranes.

Before an abdominal operation can be performed, section of the parietes—a proceeding, in itself demanding some surgical skill and knowledge—has to be concluded; and, when the operation proper is finished, the accurate closure of this wound, in a manner fully to meet the immediate and remote demands made upon its union, requires more care than does an ordinary surgical wound. The manipulations in the cavity have to be performed frequently at some distance from the surface, sometimes out of sight, and are often of a difficult and delicate nature. Through the whole proceeding, careful avoidance of injury to vulnerable organs by rough handling or exposure, and minute and continuous attention to secure absolute cleanliness in hands, instruments, and sponges, are especially important. Lastly, certain well-established rules as to the environment of the patient, and the management of the case, must be attended to. These and such questions, being common to all abdominal operations, will now be considered in detail.

ENVIRONMENT OF PATIENT.

*The Sick Room.**Admission of Visitors.**Purification of Atmosphere.**Bed and Bedding.**Nurse.*

The Sick-room.—There is no disputing the fact that the best results in abdominal surgery are got in specially prepared rooms or wards. It is true also that the mortality in large general hospitals is greater than in small specially designed hospitals. But it is further a fact that the most experienced operators are attached to the small special hospitals; and it is therefore impossible to say how far the good results are to be attributed to the surroundings of the patient, and how far to the skill of the surgeon. That an *a priori* probability of the greatest success would be got in specially designed hospitals fully under the control of a highly-skilled surgeon, there is no question; and this would hold true of any surgical operation in the hands of a man who specially devoted himself to it. But, at the present time at least, it is perhaps nearly as true of abdominal as of other operations, that extra care in avoiding all matters conducive to septicism will, with surroundings such as most surgeons can command, justify their being carried out either in general hospitals or in private dwellings. Very few surgeons can begin an operation of any sort with the consciousness that the patient is being submitted to the best conceivable conditions for recovery: much that is justifiable is not perfect.

This, of course, is no argument against every effort being made to secure for the patient the best possible surroundings. An ideal room—situated in an open and elevated locality, ventilated with warmed (and perhaps filtered) air, wall and floor impermeable to moisture and readily and easily washed, and with many other excellences which could be detailed—is rarely in this country at the disposal of surgeons. Such rooms, abundant enough in America and on the Continent, are usually erected at the private

expense of the operators. In only a few hospitals in England are there specially prepared private wards for abdominal surgery.

If the operation has to be performed in a private dwelling, a large, bright room with a southern aspect, and which can be kept comfortably warmed and well ventilated, ought to be selected. A room that has not been constantly occupied as a bedroom is likely to be more fresh and sweet than one that has been so occupied. Carpets, curtains, and everything that may harbour dust and filth, ought to be removed. A well-kept bedroom, in a home of gentle-folks, will require nothing changed or removed.

If the windows are kept open for twenty-four hours or so, while a large fire is kept burning in the grate, the room will be freshened and purified, and thus made, not only a more pleasant, but a more safe habitation for the patient.

Admission of Visitors.—The question of the presence of visitors at the operation has been much discussed. Some surgeons admit no visitors beyond their immediate assistants; others admit a limited number, who declare that they have not recently been in contact with septic products; not many admit visitors without restriction of any sort. If the room is small, one would certainly rather not have the air made foul by crowding; and in every case, one would not care to have in the room individuals who have recently come from contact with cases of pyæmia or erysipelas. But if one has full confidence in the purity of the immediate surroundings, and the room is large, I see little necessity in being particular as to the admission of onlookers, wherever they may have come from, and whatever be their number. In the Bristol Infirmary, we operate in the general theatre, placing no restrictions whatever on visitors; and there has been no harm therefrom. The results are equal to those got in any special hospital.

Purification of Atmosphere.—Some surgeons seek to improve the purity of the atmosphere in which the operation is to be performed by making a steam antiseptic spray play in the room for a few hours. There is no strong objection to this: if it does nothing else, it lays the dust. But if the room has been properly cleansed

and ventilated, and the surrounding air is of the moderate purity and freshness that may be found almost anywhere in England, the spray in the room is uncalled for. If any objection could be raised to the proceeding, I think it ought to be on the ground of saturating the atmosphere with moisture. Respiration is not so easy in an atmosphere laden with moisture, as in one that is dry; and if a patient has to undergo a prolonged and dangerous operation, we should desire to have the recovery from shock promoted by every possible surrounding benefit—one of which is certainly not a wet, depressing atmosphere to breathe. The atmosphere is best purified by permitting the dust to settle for some hours before operation.

As to the *beds* and *bedding*, no special directions need be given. A narrow bed, preferably with spring or woven-wire bottom, on which is laid a good horsehair mattress, will satisfy all requirements. I prefer to have two beds; the patient being lifted, in the sheet on which she lies, from one bed to the other every night or morning, or both night and morning, and the unused mattress being taken out of the room to be dried and aired. This, however, is a luxury, and not a necessity.

For *clothing*, I think the best plan is to entirely discard the night-dress, and use instead a jacket, made of fine flannel, which reaches as far as the loins. If the patient desires it, linen drawers may be worn. Free access to every part of the abdomen, with warmth and lightness, are the chief requisites in the clothing of such patients.

The Nurse.—For nursing abdominal cases, no special skill is necessary in the attendant beyond ability to pass the catheter with gentleness and dexterity, and without moving or exposing the patient. Clumsiness in this art worries the patient to an unnecessary degree: and this worry the surgeon may know nothing of, as the patient believes it to be a necessary part of the treatment, and does not complain; while the nurse is not likely to speak of her own awkwardness. It is extraordinary how rarely we find even the most skilled nurse able to catheterise a patient

secundum artem. It will, therefore, be well to see the nurse pass the catheter at least once on each new patient. If she fails in dexterity, a hint as to any peculiarity of conformation, and the way to overcome it, will give her confidence in future acts of catheterisation. Beyond this, the nurse must have a perfect familiarity with the use of the rectum tube, which may be left to her discretion; and a practical knowledge in the administration of enemas. A perfect nurse is a perfect woman, rarely to be had; but good temper, implicit and uncomplaining obedience, gentleness, cleanliness, and some degree of physical strength and endurance, are absolutely essential.

In simple cases, one nurse will be sufficient, as after the first few days she may have full rest. In bad cases, it is wise to have a day and a night nurse. Not only will they give better nursing, but they will give some variety to the patient, and be more bright and cheerful in the sick-room than if they were tired and over-worked.

PRELIMINARIES TO OPERATION.

Preparation of Patient.

Operation Table.

Coverings of Patient.

Warmth.

Light.

Assistance.

Antiseptics.

Preparation of Patient.—In most cases, all that is wanted by way of preparation is the administration of a purge the day before operation—supplemented, where deemed expedient, by a simple enema. The last two or three meals should be of such a nature that no residue will be left in the bowel at the time of operation. If peritonitis or enteritis supervene, it will be one point in favour of good progress that there are no irritating matters in the bowel. Starvation for two or three days before

operation, as has been recommended, is unnecessary and detrimental. The advantage of having to operate with collapsed bowel inside the abdomen is more than counterbalanced by the weakening of the patient which such a procedure induces.

I think that the advantages of catheterism before operation are somewhat exaggerated. I am convinced that it is unnecessary, and I never have it done. The patient may pass water before operation; if there is some abnormal condition in the bladder which prevents her being able to empty it, I would as soon find this out after operation as before. We can see and feel, and accurately locate, an enlarged bladder if it is distended; lying flat and empty over a growth, we may unwittingly injure it. If the bladder contains so much urine as to be in the way of the operator, it may be emptied by an assistant: this, however, will rarely be necessary.

If the patient is of the lower classes, it will be well that she should have a warm bath, and have her skin well cleansed with soap and water. Apart from the increase of comfort,—a result not to be lightly estimated,—the advantages, in aiding free cutaneous action by removing layers of effete epidermic scales and accumulated dirt, must be considerable, especially in cases where the renal functions are not quite normal. At the site of the wound, particular care is to be taken with the cleansing process. The parts are soaked for twenty-four hours previously, by several layers of lint containing 1-30 carbolic lotion; and the umbilicus and pubes are scrubbed with a nail-brush. The pubic hair need not always be shaved: septic matters lodge rather in the hair follicles than upon the hair itself. The hair had better be shaved if drainage or if extra-peritoneal treatment of a pedicle are to be adopted.

Operating Table.—Any ordinary operating table will suffice. It should be narrow, and it should not be low. A simple deal board, about two feet broad, placed between trestles or tables, or any other solid support, makes an excellent operating table. The height of it should be regulated according to the height of the surgeon. Nothing is more tiring than to bend over the

work during a long operation; and such weariness would undoubtedly tell upon manual dexterity. A table, three feet to three feet four inches in height, will elevate the patient so that the surgeon can stand up to his work. The patient's arms are confined by a piece of bandage or broad webbing carried round the operating table, and fixed, by a clove-hitch or other convenient means, around the wrist. The legs are confined by tying the bandage over the knees and under the table. For confining the arms I am in the habit of using the well-known wristlets invented by Mr. Prichard for lithotomy; the hooks being fixed into holes made in a broad piece of webbing, which is passed under the operating table. Apparatus specially made for the purpose may be purchased.

For Hospital work I have designed an operating table which gives every possible position of patient, and can be raised to any height required by the surgeon. (FIG. 10.) It is made entirely of



FIG. 10.

Operating Table. Ordinary position.

steel tubing and glass, the metal work being plated or enamelled. Thus it is very easily cleaned. The ends can be raised separately or conjointly; the middle also can be raised, giving the Trendelen-

berg posture. (FIG. 11.) A large movable receptacle hung under the table serves to collect ovarian or irrigation fluids; a movable shoot or gutter may be attached to the side of the table to conduct the fluid into the receptacle. For specially prolonged operations on feeble patients, the addition of artificial heat is made by means



FIG. 11.

Operating Table, arranged for Trendelenberg posture.

of large rubber cushions or coils of tubing filled with hot water. Hot-water rubber bottles placed alongside the body, and between and by the sides of the thighs and legs, do equally well. There is a head-rest movable into any position, the pillow being a self-adjusting ring covered with rubber.

Coverings of Patient.—In every case the patient should be so covered up that as little as possible of the body heat will be lost. Two warmed blankets are placed on the operating table, and folded separately, so that one can be turned over the front of the lower limbs, and the other over the chest and upper abdomen. A convenient plan is to have the two blankets sown together into one, and then cut transversely like a many-tailed bandage, the

tails or flaps being laid over the body, and those flaps which overlie the seat of operation being rolled up and placed by the side of the patient. If it seems advisable to take extra care to keep the patient warm, a layer of cotton wool over the chest and under the flannel jacket, and rolls of wool around the limbs under the blanket, may be used in addition to the heating measures already described. Special combination suits which completely envelop the patient may now be purchased, and are perhaps best of all for wear in the operating room.

When the patient is properly protected against cold, the whole body, from chin to feet, is covered with a sheet of macintosh in which an opening has been made, of size and shape convenient for exposing the area in which the operation is to be done. An oval opening, about seven inches long by four broad, will be found suitable for the majority of operations; the sheet itself, so as completely to cover the patient and to hang over the sides of the table, must be about six feet square. The opening is made about two feet from the top.

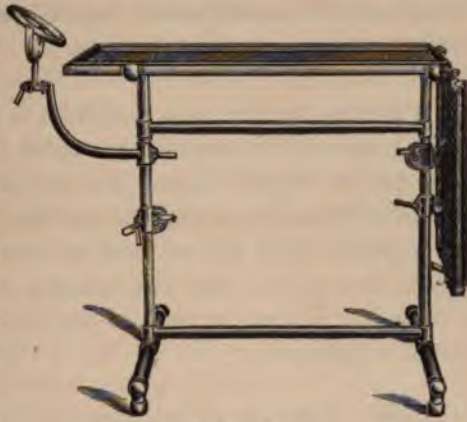


FIG. 12.

*Operating Table, arranged for gynecological posture.
(Kolpo-hysterectomy.)*

On the under surface of this macintosh sheet, around the margin of the opening, is spread adhesive material, such as is used on ordinary adhesive plasters; the edges of the opening are thereby made to adhere closely to the skin, leaving exposed only as much of the abdominal wall as is necessary for operating. The impervious sheet prevents loss of heat by evaporation, and keeps the patient and her coverings clean.

In every abdominal operation I should use this sheet of

macintosh. Its virtues may be more conspicuous in the removal of large cystic growths, where it keeps the patient dry and serves to guide the fluid into the receptacle provided, than in small or solid growths, where such uses may not be called for. But bowels may be extruded in any abdominal operation; and blankets, towels, or sheets may become displaced and get in the way. The impervious rubber sheeting, when washed, provides a field for operation which is always clean, and it keeps everything else out of the way.

A few sponge-cloths, wrung out of warm antiseptic lotion, laid over the macintosh around the field of operation, will be found very useful for wiping soiled fingers upon, and, if requisite, for throwing over extruded intestines.

Warmth.—It is not wise to operate in a room under 60° Fah.; but the necessity of warming the room up to 70° Fah. or higher need not be insisted upon. Evaporation is the chief cause of cooling of the peritoneum; and this is prevented by packing into the exposed cavity soft warmed sponges, and by protecting extruded viscera with large flat sponges, or several layers of thick soft cloth. General warmth of the body is maintained by the methods indicated.

Light.—The use of artificial light during daylight for the purpose of searching for bleeding points in the deep parts has been recommended. For this purpose an electric lamp is, for obvious reasons, undoubtedly the best. I have no experience of the electric lamp for this purpose, and have never found the necessity for its use; though, in a badly-lighted room on a dark day, I can readily conceive that it might prove of great assistance. A hand mirror is often useful for throwing reflected light into the cavity.

Assistance.—Besides the anæsthetist, one assistant is all that is wanted for most abdominal operations. Such an assistant ought to be familiar with the methods of the operating surgeon; able, with swiftness, precision, and dexterity, to second and

facilitate his proceedings at every step. He must have no opinions of his own as to operative details, but try to follow implicitly the mental direction of his chief. His duties are simply those of the operator; he acts as his third or fourth hand. A skilled assistant is thus on the high road to becoming a skilled operator; and he frequently reaches this goal. If an unskilled assistant has to be used, I think a medical student is of more use than a tried surgeon who has no experience in abdominal surgery. The student will do what he is told, and no more. As a matter of fact, in most cases of abdominal surgery, an assistant of any sort is a luxury rather than a necessity. As personal experience increases, the two hands become capable of doing more and more; and, with the exception of some minor manipulations, which might easily be performed by a nurse, the surgeon can do most things without assistance of any sort. But the unexpected often happens in abdominal surgery, and the presence of a skilled assistant in any of the numerous accidental emergencies will so frequently be of conspicuous advantage, that it will be wise never to operate without one.

Antiseptics. Purification of Hands, Instruments and Skin. Clothing of Surgeon.—The most perfect surgery is aseptic rather than antiseptic. All antiseptics are more or less irritating, and thereby to some extent, however small, harmful to the wound or the peritoneum; if there is no septic material in the air, fluids, fingers, sponges, or instruments that come into contact with the wound or the peritoneum, antiseptics are also useless. That perfect purity of every material which touches the inside of the abdomen is absolutely essential all are agreed; the only questions now in dispute are as to whether this purity is to be secured by sterilisation or by antiseptics. And this is a matter more of practice than of principle.

Purification of the air by the steam spray has now been generally given up. Even in large hospitals, where atmospheric impurity if anywhere would have most influence for evil, the spray has been abandoned, and the opinion is almost unanimous that

its abandonment has not been harmful. It is known, however, that atmospheric dust is full of germs; and operations should be performed in still rooms.

The practical working of the aseptic principle in modern abdominal surgery is broadly as follows:—All bodies that come into contact with the wound or the peritoneum must be sterile as regards micro-organisms. As regards *instruments*, this is best done by heat, either boiling them in water with soda or placing them in a steam steriliser. The instruments during operation lie either in water that has been boiled and so sterilised; or in water containing sufficient germicide to be sterile. Water which has been boiled is probably practically sterile for several hours; at a temperature of 90°—100° Fh., when it would be used, germs might live in it. Warm carbolic lotion of 1-40 strength is actively antiseptic as well as sterile; and therefore I prefer to have the instruments in this medium. It is, however, a matter of small importance whether boiled water, if used soon after boiling, or antiseptic solution is used in which to place the instruments.

The *hands of the surgeon* are treated as every other foreign body coming in contact with the wound, and rendered, as nearly as may be aseptic. Under ordinary circumstances, a thorough scrubbing in hot water with soap and nail-brush, and a subsequent soaking for a few minutes in 1-30 hot carbolic lotion, is quite efficient. In exceptional circumstances, that is to say if there is the slightest suspicion of recent contamination, the method of purification by first soaking the hands and arms in solution of permanganate of potash, and then washing them in solution of oxalic acid, may be adopted. For some years I have used this method, either alone or with the addition of sodium hyposulphite, for the cleansing of sponges. If I thought that extra care was advisable in manual purification, it has been my habit to spend half an hour before an operation in purifying sponges and so letting the hands and arms partake in the cleansing. Many other good methods of cleansing the hands are in vogue. It need scarcely be added that special care is to be given to the nails and the sulci which underlie and surround them.

The *skin of the patient* surrounding the wound must also be

subjected to the cleansing process. Many methods are available, but I doubt if any of them are thoroughly trustworthy. At all events, I prefer to act as if the skin always retained septic elements. It is practically impossible to desepitise the hair-follicles; however thoroughly we apply detergents and antiseptics, we can never be certain that no septic filth lurks in these recesses. Ether to dissolve the fatty and sebaceous matters, and the penetrating carbolic lotion to kill the germs, are perhaps as efficient purifying agents as we can employ. The permanganate and oxalic acid process is a very good one. For ordinary work I can speak favourably of a thorough cleansing with soap and brush, and the subsequent application for twelve hours of a pad of lint wrung out of carbolic lotion. During the operation active antiseptics, either on sponge-cloth or in lotion, overlie the skin, and the risk of contamination is infinitesimal. After operation sufficiently powerful antiseptics either fill the hair-follicles or reside in the dressing applied. Danger from germ-laden skin is thus practically abolished.

Intra-abdominal antiseptics, strong enough to be germicides, are of doubtful utility. The exquisite tenderness of the peritoneum forbids the use of strong antiseptics; and antiseptics which are not strong are not germicidal. Removal of septic collections by aspiration and flushing and drainage is more relied upon than the destruction of their septic properties by the addition of antiseptics. Mild antiseptics are however of occasional benefit. Of these the favourite is iodoform. Although organisms thrive in iodoform outside the body, it seems in the body to have a beneficial action by the liberation of a product, possibly iodine, which nullifies or restrains the action of the bacterial toxins. Iodoform in gauze, or in emulsion or pure as a powder, is frequently used with advantage in abdominal surgery where suppuration or foul collections are met with.

For cleansing the peritoneal cavity sterilised water or salt solution are most frequently used. I prefer boro-glyceride solution of the strength of about half an ounce of the chemical to a pint of water. Both water and salt and water are injurious to

the delicate endothelium; boro-glyceride is not. A few minutes study of the action of these liquids on the mesentery of the frog will soon convince one of this. If the patient is not anæsthetised, he will tell us that pain is less during irrigation with boro-glyceride solution than with either plain water or saline solution. Further, boro-glyceride is undoubtedly antiseptic, even if mildly so, and it is a rapid solvent of clot and coagulated materials. For these reasons I prefer boro-glyceride to anything else for cleansing the abdomen. I frequently leave a teaspoonful of pure boro-glyceride in a cavity from which putrid fluids have been removed; there its ready solubility and hygroscopic nature soon convert it into a lotion of considerable antiseptic and deodorising powers.

As an element in aseptic surgery, the *surgeon's clothing* is of some importance. Clean linen or macintosh coats or aprons should be worn by the operating surgeon and his assistants. Everything which is not sterile should be covered by something which is sterile or is impervious to germs. And this applies not only to the clothing of the surgeon and his assistants, but to blankets, towels, dressings and everything which comes near to the seat of operation.

In my own experience, I think I have found that it is better to employ active antiseptics than to rely on simple sterilisation. It is certainly easier, and I believe it is safer. The seeking for genuine asepticism is more praiseworthy than successful; for work-a-day purposes germ killing may conveniently supplement germ exclusion.

SURGICAL ARMAMENTARIUM.

Sponges.

Sponge-Cloths.

Ligatures and Sutures.

Instruments.

Sponges: their Selection, Preparation, and Purification.—The very finest Turkey sponges should be used. It is difficult, even in large collections, to find the sort of sponge that is suitable for

abdominal surgery. They must be very soft, of the finest texture, elastic and compressible, and of various shapes and sizes. Several very large thin and flat sponges are necessary to cover extruded bowels or omentum on which a number of compression forceps may have been placed. A number of somewhat flat sponges, of about the area of the open hand, are requisite for packing inside the abdomen, to prevent extrusion of bowels, and to absorb blood and fluid during the separation of adhesions. Lastly, small round sponges are necessary for general purposes—for sponging the wound, for packing into spaces where larger ones will not go, and for mopping out the peritoneal cavity.

The preparation and purification of sponges requires the most careful and close attention. This duty cannot safely be relegated to assistants; the surgeon must do it with his own hands. The sponges are first cleansed from the sand which occupies their meshes by repeated washings in water. At the end of about a week, the water having been changed at least twice daily, all the large fragments will have been washed out. They are left for three or four days longer in water acidulated with hydrochloric acid, in amount sufficient to make the fluid taste distinctly of the chemical. This bleaches the sponges a little, but scarcely alters their texture. They are then (according to one method), after washing in pure water to remove the acid, placed in a solution of ordinary washing soda (about a pound of soda to the dozen sponges is the proportion that Tait advises), and left there for not more than twenty-four hours. They are washed and squeezed several times in this fluid, which they render slightly cloudy. They are now very soft. Finally, after being taken through clean water to remove the soda, they are soaked for a few hours in 1-20 carbolic lotion, squeezed as dry as possible, and artificially dried by heat. When they are perfectly dry, they are laid aside in a dry place, well covered up, preferably in glass jars, till they are wanted.

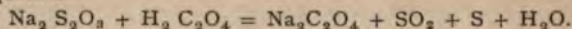
After an operation the sponges may be purified in a somewhat similar manner. Having been washed in water to remove as much of the filth as possible, they are placed in the soda solution, which effectually dissolves out the blood and fibrine, and repeatedly washed and squeezed in it. The soda solution is

changed several times. When every particle of filth has been removed, they are cleansed in water, dipped in carbolic solution, squeezed and dried, and kept in a dry place till further use.

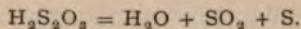
Another very excellent mode of cleansing sponges is recommended by Borham. After giving it a full trial, I have adopted it entirely in preference to other methods. The sponges are first soaked in a one-per-cent. solution of permanganate of potash; the permanganate is then washed out by repeated squeezings in fresh water. This part of the proceeding may be neglected; I doubt if it is of much value. The sponges, ten or twelve in number, are then placed in a gallon of water, in which half a pound of sodium hyposulphite has been dissolved; the amount of solution being increased according to the number of sponges. Then about four ounces of oxalic acid are added, and a chemical action takes place which rapidly bleaches the sponges and dissolves out any fibrine contained in their meshes.*

* Mr. W. A. Shenstone, Chemical Master at Clifton College, has very kindly supplied me with the following explanation of the reaction:—

The use of sodium hyposulphite (properly sodium theiosulphate) no doubt depends upon the formation of a solution of sulphur dioxide, SO_2 , according to the equation—



The rather tardy appearance of the precipitate of sulphur being possibly due to formation, in the first instance, of hyposulphurous acid, $\text{H}_2\text{S}_2\text{O}_3$, which, however, if formed speedily undergoes decomposition according to the equation—



If the precipitate of sulphur that accompanies the sulphur dioxide be objected to, sodium sulphite ($\text{Na}_2\text{SO}_3 \cdot 7\text{H}_2\text{O}$) may conveniently be substituted for the sodium hyposulphite.

Small quantities of sulphuric acid are formed in the bleaching process, and a solution of sulphur dioxide absorbs oxygen from the air with production of sulphuric acid; therefore, as the presence of this compound in the water that remains adherent to the sponges when they are placed aside to dry tends to rot them, they must be very thoroughly washed with pure water after treatment with the bleaching liquid. From the above equation it will be seen that the hyposulphite and the acid may conveniently be used in molecular proportions. Both oxalic acid and sodium hyposulphite crystallise with water of crystallisation however ($\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ and $\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$), and, therefore, they should be used in the following proportions, viz.: 248 parts of crystallised sodium hyposulphite to 126 parts of oxalic acid. In practice two parts of the salt to one of the acid will be a sufficiently close approximation to these theoretical numbers.

The sulphur dioxide is a powerful disinfectant as well as a bleaching agent, and being generated in the meshes of the sponges, reaches every part of them. The sodium oxalate acts as a softening agent and dissolves out the fibrine. It takes a good many washings in water to get rid of the free sulphur; but this is rather an advantage than otherwise, for if we follow the rule never to consider the sponges cleansed till the water squeezed out of them is quite clear, this freedom from sulphur is a good working test of the purity of the sponges. Sulphur itself is a mild antiseptic (from slow oxidation and formation of sulphur dioxide); and the sponges may at once be dried and laid aside after washing. I usually dip them in carbolic acid, however, before doing so. If the precipitate of sulphur is objected to, sodium sulphite may, as Mr. Shennstone suggests, be used instead of sodium hyposulphite.

The sponges, for reasons explained in the foot-note, must not remain in the solution longer than ten minutes.

Sponge-cloths.—As supplementary to, and as substitutes for, sponges, the loose, porous, absorbent, cotton towels known as sponge-cloths are of great value. They are used wrung out of warm antiseptic solutions to cover the macintosh which surrounds the area of operation; they serve as sponges to absorb blood and fluids in all extra-abdominal operations; they serve as coverings for extruded viscera, and in many other ways they are invaluable. They are boiled after every operation; and every boiling seems to improve them. Now I never perform an operation without using them.

Absorbent pads made of wool and wrapped in gauze bags are in favour with some surgeons. They are antiseptic, and as they are burnt they cause no future danger from septicism. Practically I do not think highly of them. They absorb slowly; they do not instantaneously absorb fluids or blood like sponges or sponge-cloths; it takes half a dozen sponge-pads to do work equal to one good sponge. And as their supply has to equal the demand, their number has to be correspondingly uncertain. Inside the abdomen they are useless and dangerous. Artificial sponges and sponge-pads I would exclude from abdominal surgery.

Ligatures and Sutures.—For ligatures the best material is silk of the variety known as Chinese twist; for sutures, either silk-worm gut or plaited silk such as are used in rod-fishing.

As material for ligature there is no strong objection to cat-gut; I have used it and nothing else in more than twenty ovariectomies, and found it perfectly reliable. Its drawbacks are, the trouble necessary for its perfect preparation, and its tendency to deteriorate by keeping; such drawbacks being, in my opinion, of sufficient weight to justify its being displaced by the more handy and equally trustworthy silk twist.

Chinese twist is made in different sizes; the sizes $\frac{1}{2}$, 2, 4, and 6 are quite sufficient for all practical purposes in abdominal surgery. The thickest is strong enough to bear as much strain as

a very powerful man can put upon it, and is used for tying thick pedicles; the thinnest is adapted for the finest work, such as suture of wounds in bladder or intestine. The medium sizes are used for tying thin pedicles and ordinary adhesions. For holding these four varieties of silk, I have had a stand made which is very portable and always ready for use. It consists of a solid rubber case, on to which is screwed a cap which keeps it practically air-tight. (Fig. 13.) Into this case fits a leaden disc, which is heavy enough to remain stationary while the silk is being



FIG. 13.

The Author's Reel-holder. Half-size.

drawn out; and on this disk, supported by upright rods of metal, are placed the four reels. A glass plate, perforated in four places for the threads, is screwed on to the top of a central bar. Before using it, the leaden disc with the reels and thread is placed in boiling water for ten minutes, and then returned to its case, into

which sufficient 1-20 carbolic lotion has been placed to cover the glass plate. To prevent their being acted upon by boiling water the reels are made of metal, and to prevent rusting all the metal is nickel-plated. After being used the lotion is poured out and the cap screwed on. The silk, treated and protected in this way, may be used daily, without further boiling, for several weeks: none is wasted; it is just as trustworthy at the end of six weeks as at the end of six days; it is always ready for use, and the apparatus is so simple that it can scarcely get out of order.

For suturing the parietal wound, I have come to the conclusion, after giving it an extensive trial, that no material is superior to silk-worm gut as introduced by Bantock. In every variety of surgical operation I have tried it, and everywhere it exhibits the same virtue in causing no irritation. I have purposely left it in the tissues for weeks, and even months, and I have never seen its presence followed by the formation of pus. In the sense of being unirritating it is superior to any suture material with which I am acquainted. Its drawbacks are, that it is somewhat stiff, not very easy to manipulate till one is familiar with it, and rather friable, being liable to break if the second cast in the knot is pulled too tightly. The stiffness may be partly removed by soaking in warm water for ten minutes before operation, and the danger of its breaking may be lessened by making the first cast a double one and tying the second one very lightly. Another objection, which at the same time speaks in its favour, is that, when the suture is being removed, it lies so firmly embedded in the tissues that a somewhat sharp tug is required to drag it out of its bed. This, however, may be because the suture needle which I use is smaller than ordinary. The strongest objection, in my opinion, to silk-worm gut arises in cases where there is much straining and vomiting, then it may cut through the tissues. In one such case where the incision extended through the umbilicus, the gut cut clean through the thin tissues and permitted protrusion of bowels. Care in selecting only such threads as are round and thick may obviate this; but I should always advise the placing of a few thick silk sutures at points where the parietes are thin, in cases where abdominal strain is likely to be produced.

The gut is that ordinarily used by fishermen, and need not be described. I have found the best gut in the shops of good fishing-tackle makers; in the ordinary trade bundles, perhaps twenty threads, specially smooth, round, and thick, are found suitable for surgical purposes.

After silk-worm gut, as suture material, I should place the plaited silk recently patented for use as fishing lines. Its chief advantage over twisted silk is that it does not kink in the eye of the needle or in the suture openings, while it is more closely knit and does not offer so large a surface for absorption of inflammatory products. It is also very strong. The trade reel of plaited silk used in the suture instrument to be presently described makes a handy and efficient suture apparatus.

For certain special operations as nephropexy, a thick absorbable suture material such as kangaroo-tendon or ox-aorta must be provided. These do not become absorbed so quickly as catgut; they can be made thoroughly aseptic, and they do not cut friable tissues such as liver or kidney.

Instruments.—The instruments to be used in an abdominal operation must be thoroughly clean; they must be conveniently placed within reach of the operator's hand; and they must be of a known number.

Cleanliness, in the fullest sense of the word, is an absolutely essential quality of every instrument. To insure this, all steel instruments (not cutting) should in the first place be nickel-plated. Then filth is less likely to be overlooked, and is not liable to be mistaken for rust or tarnish. After every operation they should be thoroughly cleansed and dried; and before every operation they must again be purified. Some surgeons, before operation, hold every instrument for a little while in the flame of a spirit lamp; others subject them to boiling. The steam steriliser, of which there are several varieties now in the market, is the most efficient means of purifying instruments; but it is somewhat cumbersome, and does not remove foreign matter. Practically it will be found that scrubbing with a brush is the most convenient way of removing filth from instruments.

Smooth surfaces may be wiped several times with a sponge-cloth soaked in lotion; irregular surfaces and joints must be scrubbed. The notched blades and the joints of catch-forceps require most attention. A good plan is to dip the blades of each forceps into a dish containing soft soap, and then scrub it with the brush dipped in hot water till lather ceases to form. Nothing softens filth better than soft (potash) soap; and when every particle of soap has been scrubbed out of the notches and recesses of instruments, we may be certain that no filth is left behind. After they are scrubbed the instruments are thrown into hot water and left there for a few moments. Then they are placed in the steriliser or boiling kettle. Before an operation they are placed in fluid, water or lotion, as the case may be, to be ready for use. Carbolic lotion of the strength of 1-40 is the best antiseptic fluid for placing instruments in; corrosive sublimate is inadmissible, because of its action upon steel.

Flat trays, an inch or more in depth and of various sizes, are used for placing the instruments in. Porcelain trays such as are used by photographers do very well; they are easily cleansed, are impervious to acids, and, being white, show up instruments laid in them. As they are, however, somewhat cumbersome and fragile, they are not very convenient for being carried about to private operations. For use in private hard rubber trays do well. They may be procured in "nests" of all sizes; and four or five such, of dimensions suitable to the nature of the instruments to be used, may be put in the operation bag, the total space occupied being no more than the largest tray. Each tray has its variety of instrument. In one are the cutting instruments; in another, the small catch-forceps; in another, large forceps; in another, trocars or clamps, or drainage tubes; and so on, according to the instruments to be employed. Every instrument is removed from its tray by the surgeon himself as he wants it, and after being used is at once replaced in the fluid. For convenience in carrying the instruments to operations in private, I have had a sort of chest made, into which the trays (made of solid rubber) fit and can be removed. Each set of instruments is placed in its own tray; and before operation the trays are removed, arranged on

the table and filled with warm lotion. The small chest of trays fits into an ordinary operation bag containing dressings, sponges, and lotions.

The instruments should be counted before each operation, so that there may be no possibility of leaving instruments inside. In the case of bulky instruments this mistake is not likely to happen. It is a good plan to always work with simple multiples of each instrument; for example, in the case of pressure forceps, which are most likely to be lost: twelve pairs of smallest size in one tray; six pairs of medium-size in another tray; and six pairs of large size in a third tray. The habit of having two or three instruments of one sort laid out, in case one is found faulty, is not a good one; each instrument should be tested and ascertained to be perfect before operation. The surgeon who has two or three scalpels and two or three pairs of scissors laid out for operation is not likely to be so well served as he who has only one of each.

The instruments most generally employed in abdominal operations may here be shortly described. Special instruments are described under the operations in which they are employed.

Of cutting instruments, *scalpels* are of the ordinary surgical type; scissors of special shapes are employed. Many surgeons (myself among the number) have only one scalpel, which is used in all operations and is never sent to the instrument-maker to be sharpened, but is sharpened by the surgeon himself. A few dexterous touches on a fine sharpening steel immediately before operation will provide the keenest of cutting edges. For



FIG. 14.

*Author's Dissecting Scissors.
Half-size.*

this invaluable hint I am indebted to my friend Mr. Jordan Lloyd, of Birmingham.

Scissors are extensively used in abdominal surgery, and several varieties may be in readiness. A powerful broad-bladed scissors, bent on the flat, is useful for dividing the parietes or cutting through thick pedicles. For dividing ligatures and sutures a special short-bladed scissors should be used; dissecting scissors are readily blunted by cutting silk or silk-worm gut. The scissors (Fig. 14) which I use for nearly every purpose is elbowed, moderately sharp-pointed, with strong blades, which form when closed an apparently solid round probe. The handles are exactly the same as in catch forceps, with the handling of which



FIG. 15.

*Author's Clamp Scissors.
Half-size.*

the surgeon is especially familiar. The blade can be slipped readily under fascia to divide it; it will divide the thickest parietes; the rounded outlines keep away bowels or other organs from the line of division, and the sharp points permit accurate limitation of the cutting.

An instrument which is sometimes useful is the scissors clamp (Fig. 15) which I devised.

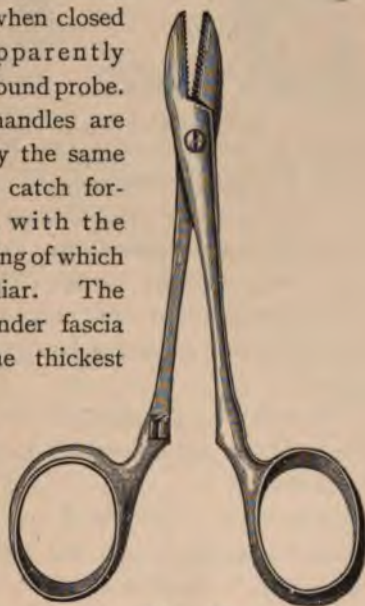


FIG. 16.

Tail's Catch-forceps. Two-thirds size.



FIG. 17.

*Wells's large pressure forceps.
Blades straight. One-third size.*

instruments. Besides these small hæmo-static forceps, instruments of various sizes on the same principle, up to the largest sizes, are necessary. Of these some have straight blades (Fig. 17), some are bent at an obtuse angle (Fig. 18), and some are bent at right angles.

Thornton's T-shaped instruments (Fig. 20), in all sizes, are frequently found useful.

For some time past I have been using forceps in which the teeth run parallel to the outside of the blades and not transversely. (Fig. 21.) These have more holding power than forceps of the

It may be employed for the bloodless division of broad thin bands of inflammatory tissue or peritoneum or omentum. It consists of a strong clamp, inside one of the blades of which is a concealed knife which, when elevated by a lever, cuts through the crushed tissue.

Forceps in great variety are extensively used in abdominal surgery. In England, Wells's forceps or some modification of it is in almost universal use for every purpose for which forceps can be used. Tait's (Fig. 16) modification of Wells's pattern has some advantage in its sharp points, which can scarcely be included in a ligature; the handles are the same as in Wells's



FIG. 18.

*Wells's large pressure forceps.
Blades bent. One-third size.*

ordinary pattern; in whatever direction they are pulled, they will not slip. It is not safe to pull laterally on forceps with transverse serrations on their blades, they may slip; the disadvantage of this when large masses of vascular tissue, such as the broad ligaments, have to be pulled up for ligation is self-evident. As hæmostatics



FIG. 19.

Wells's large pressure forceps. Blades bent at right angles. Half-size.



FIG. 20.

Thornton's T-shaped pressure forceps. Half-size.

also they are very efficient. (Fig. 22). The tissues are caught, held sharply compressed along two lines; they are not flattened out, nor can the vessel be squeezed out of the grasp of the blades. With these forceps left on as hæmostatics for a minute or two, ligatures need rarely be applied to bleeding points.

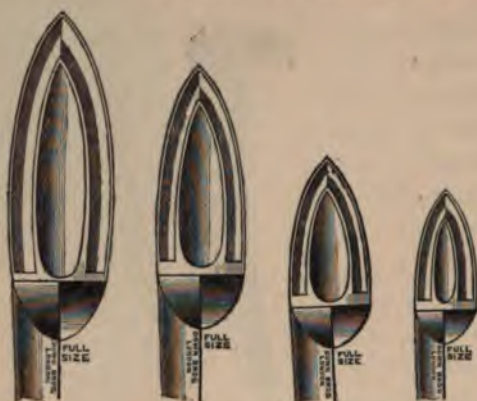


FIG. 21.

*Inside of blades of Author's pressure-forceps.
Full size.*



FIG. 22.

*Author's hamostatic
forceps. One-third size.*

Forceps on this principle are made in all sizes and bent at all angles. They may be had with detachable blades or with screwed joints.

For delicate work such as picking up the peritoneum, holding the margins of a puncture in the bowel, or helping in a delicate dissection, a specially sharp forceps on this principle (Fig. 24) is made. This instrument is very generally useful in abdominal work.

For every abdominal operation there should be provided a forceps with long handles for holding sponges which may have to be carried into the flanks or up under the diaphragm. The forceps shown



FIG. 23.

*Author's large pressure-
forceps. One-third size.*



FIG. 24.

*Author's peritoneum forceps.
Inside of blade. Full size.*

in Fig. 25 I have found suitable for this purpose.

Retractors of various forms are occasionally useful for keeping the parietal incision open during deep manipulations made in the abdomen. A useful retractor, which dispenses with the necessity for assistants, is shown in Fig. 26.



FIG. 26.

Maunsell's self-holding retractor.



FIG. 25.

Sponge-holding forceps. One-third size.

Plan of Operating Room.—The placing of patient, assistants, nurses, instruments, and operators so that the operation may be carried out with the greatest efficiency and the least amount of friction is of some importance. The

annexed diagram (Fig. 27), modified from the one in Doran's valuable work,* shows at a glance the arrangement which I consider best. The operator stands on the right of the patient and the assistant on the left. The instruments are arranged in trays placed side by side on a table, which is situated within easy reach of the operator's right hand. The feet of the patient are towards the window; and the table is so placed that the best light falls upon the field of operation. The nurse stands behind the assistant, and takes from him soiled sponges and supplies him with clean

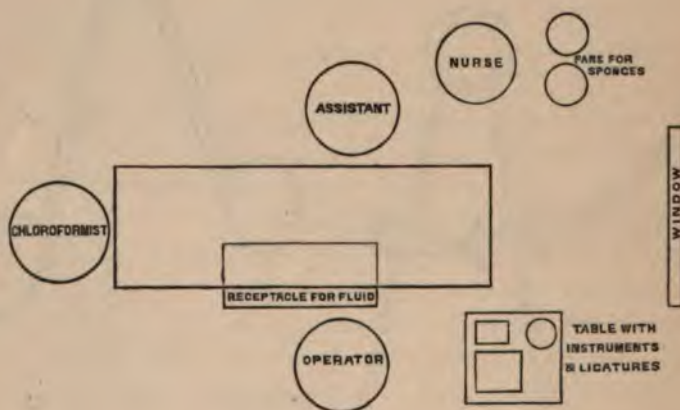


FIG. 27.

Diagram showing position of Patient, Surgeon, Assistants, &c., in Abdominal Operations.

ones. The fewer hands that sponges pass through the better; one nurse can easily clean the sponges and supply the assistant with clean ones. If a basin containing lotion is placed under the left hand of the assistant, and the nurse places the sponges, which she has cleaned in a large pan full of hot water, in this basin as they are cleaned, the assistant can help himself at once

* *Gynaecological Operations*. London, 1887. P. 200.

to any sponge he wants, and as he helps himself he squeezes the sponge dry—a duty which the nurse often fulfils very imperfectly. It is not pleasant to hear the assistant call out for a “large flat sponge” or a “small round sponge” as the surgeon wants it; it should be lying ready to his hand, and he should be able silently to help himself the moment the surgeon wants it, or he foresees its usefulness.

For ovariectomy a receptacle is placed partly under, partly by the side of, the table, for holding ovarian fluid. A long narrow trough, which is out of the way of the surgeon's legs and includes half the length of the table, is most convenient. Such a trough, with a shoot leading to it, is specially provided in the operating table described. (Fig. 10).

If a second assistant is wanted, he may stand on the left side of, and behind, the operator.

Trendelenberg Posture.—By elevating the pelvis above the level of the head, Trendelenberg considered that he greatly facilitated the performance of certain operations in the pelvis and lower abdomen. In this position the intestines gravitate away from the lower abdomen out of the way into the upper abdomen; and increased facilities in the way of seeing and handling are supposed to be thereby secured. Several distinguished surgeons have spoken with enthusiasm of the value of the Trendelenberg posture for certain operations, and many regard it as a valuable addition to surgical abdominal technics. A few surgeons, and amongst them some of our most famous English operators, reckon it of no value whatever. It is certain that in England its employment has not come into general use; it is very commonly used in America.

I have tried it now in a few cases, and I cannot speak of it with enthusiasm. Only a lax abdomen will permit of upward gravitation of the intestines; and where the parietes are lax it is just as easy to get at deep parts by other means. In the case of large solid pelvic tumours the important view behind is occluded

by the Trendelenberg posture, while the unimportant view in front is certainly improved. Its value is perhaps most conspicuous in operations on the bladder, but here also it has drawbacks. While I have not been strongly impressed with the value of the Trendelenberg posture, I desire again to state that surgeons of the highest repute speak in the most favourable terms of its value for certain operations, and that it probably has a higher value than I have yet been able to prove.

ANÆSTHETIC.

Ether, properly administered by means of a Clover's inhaler, is generally believed to be the best anæsthetic. The anæsthetic which I prefer is ether preceded by nitrous oxide gas. For old patients, or for patients who are bronchitic, chloroform is perhaps safer. Chloroform and ether mixed is favoured by some surgeons of repute. Bichloride of methylene, which is used at the Samaritan Free Hospital, has not been generally adopted. In all cases, I believe that safety and efficiency depend more on the capacity of the administrator than on the nature of the anæsthetic.

A skilled and experienced anæsthetist ought, in my opinion, to be given his choice of anæsthetic. He is told the nature and probable duration of the operation; he makes his own examination of the patient, and he is permitted to select the mode of anæsthesia which he considers best.

The Operation Itself.

THE INCISION THROUGH THE PARIETES.

Considerations as to Selection of Incision relating to :

*The Abdominal Muscles,
The Parietal Fasciæ,
Thickness and Density of Parietes,
Length of Incision.*

Examples of Incisions.

The Making of the Incision.

Closing the Parietal Incision.

Ventral Hernia.

Umbilical Hernia.

In the earlier days of abdominal surgery when everything was good if only the life were saved, little attention was paid to the parietal incision either in the making or the closing of it. Provided that it gave easy access to the abdominal work, and that it healed kindly, little more thought was given to it. Now that the prime end of life-saving has been secured we are able to devote a closer and keener attention to the ways of making and of closing the incision in the parietes. It is my purpose now to try to set out and discuss the leading principles which ought to guide the enlightened surgeon in this subsidiary but not unimportant part of abdominal surgery.

The first requisite of the abdominal incision is, of course, that it shall provide easy, or at least satisfactory, access to the work to be done. Every other consideration must give way to this. The next requisite is that it shall not appreciably add to the patient's risk. Admitting these leading requisites, there are still many subsidiary issues which demand attention. Such are : the securing of provision against the occurrence of ventral hernia ; the selection of a point in the parietes most suitable for the fixation of a hollow viscus or the wall of an abscess or cyst ; the provision of muscular

sphincteric action around a fistula; the making of an incision through which both exploration and treatment may be carried out. The one incision must seek to meet all requirements; and thus, seeking to unite a maximum of advantages with a minimum of disadvantages immediate as well as remote, many incisions will be, in a fashion, compromises. But, always, provision of room and avoidance of risk must be the leading motives. For example: probably the worst incision possible as regards weakening of the parietes is a transverse section of the recti passing on through the linea semilunaris; but such an incision is the best possible as providing easy access to deep underlying work. In such an operation as pylorectomy, with fixation of growth and perhaps enlargement of glands, the urgent necessities of the freest access and of the saving of life would make us throw aside all remote considerations as to ventral weakening or protrusion. A vertical incision in the middle line or passing through fibres of the rectus cramps the space for operating, but leaves small risk of hernia. In an actual case other considerations would arise. Thus with thick muscular parietes, a deep abdomen, and a necessity for extensive and delicate work inside, a transverse or partly transverse, section of rectal fibres would be adopted. With thin or lax parietes, a shallow abdomen, a mobile growth and no likelihood of delicate work inside, a vertical incision with separation of muscular fibres would be sufficient. In other cases a combination of methods would be adopted; perhaps a primary and harmless incision for diagnosis and guidance; and a continuation of it for the operation, regardless of everything but the saving of life and the provision of room. With this concrete and extreme example before us, there is, I trust, no possibility of misapprehending the relative weights to be given to the principles and practices to be considered.

CONSIDERATIONS INVOLVED IN THE SELECTION OF THE INCISION.

The principles involved in the selection of the incision will be discussed separately in their relations to muscle; to fascia; to the

gross structure of the parietes in regard to thickness, density, and mobility; and to the length of the incision. Then a practical and critical exposition of these principles will be made with regard to the common incisions in use. Lastly, the practical closure of the incision, and the cure of parietal and umbilical hernia, will be described.

The Abdominal Muscles.—There is no doubt that the presence of intact muscular fibre is the best provision against hernia. Hernia takes place through fascial tissues, not muscular. Any transverse division of muscular fibre leaves a permanent and irremediable weakness at the seat of division. However closely and accurately the divided fibres are joined, the cicatrix will stretch. And a further and additional weakness is caused by the atrophy of the divided ends for some distance away from the cicatricial union. Nothing can prevent this. Close suturing may keep up close apposition for months or even years, but stretching of the uniting scar will certainly take place in the end, with subsequent weakening of the parietes or hernia. It may, therefore, be laid down as a first law or principle that *the line of parietal incision should be made parallel with the direction of the most important muscular fibres.*

The Parietal Fasciæ and Aponeuroses.—Fascia, like muscle, once divided can never be replaced. The new tissue is the same for fascia as for muscle, and is equally capable of being stretched. The tensile power of a thick aponeurosis like that of the external oblique is enormous; the thin strip of cicatrix which unites the divided ends of such an aponeurosis is quite inadequate to bear the original strain. If there is an intact layer of muscle behind or in front of a divided fascia, the risk of hernia is much diminished. And, also, if intact muscular fibres are set parallel to an incision through fascia, the risk of hernia is lessened. The division of the linea alba or the linea semilunaris would be followed by hernia more often than it is were it not that the sheath of the rectus is very frequently opened and the muscular fibres directly brought into the wound region. Transverse

division of aponeurotic fibres is most harmful where muscle above or below is thinnest; where muscle is abundant, as in the lumbar region, division of aponeurosis is least harmful.

A second law may be laid down : *Separate where possible and do not divide aponeurotic fibres; where a division is necessary, let it be in a direction which will permit of the leaving intact one or other of the muscular layers behind the division or in front of it or parallel to it.* If no one of these practices is possible, then a flap entrance should be made. That is to say, the weak points do not all overlie; they are at different levels in the parietes when union is made. We might reflect skin and aponeurosis, and open muscle at the base of the flap in the lower abdomen; or we might reflect skin and muscle in a flap near the edge of the ribs, and open the deep fasciæ (here very strong) at the base of the flap.

The Condition of the Parietes as to Thickness, Density, and Fixity.—Considerations having in view the gross condition of the parietes as to excessive thickness, density and incapability of being dilated, and fixation close to any of the bony margins, must influence us occasionally.

Thus, enormous thickness from fat, or from fat and muscle combined, would forbid any incision in the lumbar region through which intestine might have to be brought. Again, although we get nearer to the colon by an incision carried well back in the loin, the advantage is nullified by the thickness of the parietes here, making it difficult to separate them, and closing in upon the work right down to it. On the other hand, an incision through thin parietes is more easily separated and leaves a free space around the seat of operation. As to fixity of parietes, the difficulty would be well exemplified in the case of a powerful muscular man in whom it was necessary to suture a rent in the bladder low down. To get mobility of incision it is not wise to go too close to the ribs or the crest of the ilium or the pubis; then the opening cannot be easily depressed or moved about. It often saves in length to have the incision mobile over the work.

A third law may be made: *Keep away from the bony margins, and avoid the thickest and least mobile parts of the parietes.*

Length of Incision.—A mean that gives free access to the work and will not unduly add to the weakening of the abdomen and prolong the operation is to be sought. Often the length of the incision is determined by the tumour, if it is solid. The seeking should be for shortness; better put up with a little extra difficulty for a minute or two than add an inch to the length of the incision. But no serious detail should for a moment be rendered more difficult to deal with for the sake of avoiding a prolongation of the incision. The actual length of the incision must have directly an infinitesimal influence on the mortality. Indirectly, by prolonging the time to be given to the operation it would influence mortality more. And, remotely, a long incision adds by so much as its length to the probability of the occurrence of ventral hernia. In some operations the length of the incision is simply the space between encroaching bones. Here the length is limited for us.

As regards weakening of the parietes, the length of the incision is of less importance than its direction. Thus an incision passing between the fibres of the rectus in their whole length would be less likely to result in hernia than a transverse incision through the fibres an inch or two long. When fibres are separated a longer incision is necessary than when they are divided, but the ultimate result to the patient is better.

The fourth law is: *Let the incision be as short as is consistent with efficiency. A long incision with separation of muscular and aponeurotic fibres is better than a short one with division of fibres.*

EXAMPLES OF INCISIONS.

With the help of the accompanying figures (28 and 29) an attempt may be made practically to apply the principles enunciated. They are intended to show the situation of the usual incisions made through the parietes and their relation to the direction of the chief muscular and fascial fibres. The external oblique muscle is shown in groups of parallel lines; the internal oblique in single wavy lines; and the transversalis in interrupted single lines.

In Fig. 28 the incisions are shown on the anterior aspect of the abdomen.

Incision No. 1. in the middle line between the xiphoid cartilage and the umbilicus, gives access to the greater part of the

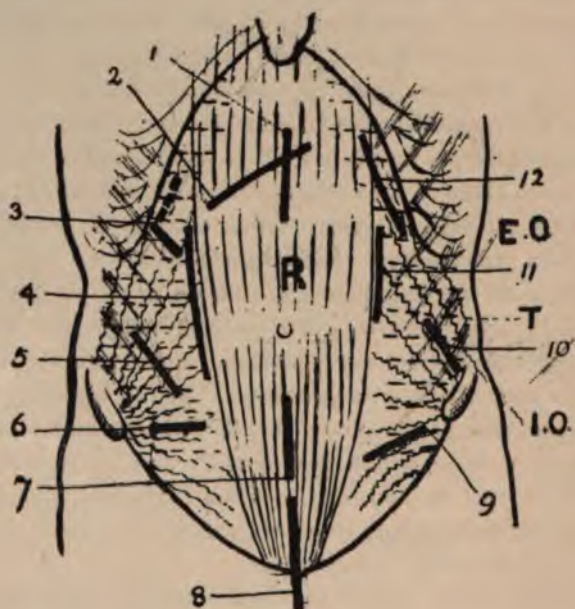





FIG. 28.

Diagram to show relations of chief incisions to directions of muscular fibres in anterior abdomen.

E.O. External oblique muscle  I.O. Internal oblique muscle 
T. Transversalis 

1. Incision for Gastrotomy, Gastrorraphy; hepatotomy, &c. (left lobe). 2. Pylorotomy—special cases. 3. Cholecystotomy: the dotted line an addition for deep operations on the ducts. 4. Langenbuch's incision for nephrectomy, colectomy, &c. 5. Incision for operations on cæcum and appendix vermiformis. 6. Incision for evacuation of collections in broad ligament. 7. Ovariectomy and operations on uterus and appendages. 8. For operations on bladder and symphysis. 9. Another incision to expose collections between layers of pelvic peritoneum. 10. Colostomy, Colectomy, &c. 11. Short Langenbuch incision: kidney, spleen, tail of pancreas, &c. 12. Gastrotomy.

stomach; through it, if the parietes are lax and thin, most of the operations on the stomach may be performed. If it is made a little to the right, freer access is given to the pylorus; moved towards the left, the body of the stomach in operations for

perforation or the removal of foreign bodies would be more easily reached. When the stomach is contracted, however, and where it has to be fixed and opened (gastrostomy), and the most direct access is essential, such an incision as No. 12 is usually more suitable. Incision No. 2 divides the fibres of the rectus, but gives very free access in such a delicate and difficult operation as pylorotomy. Such an incision leaves the abdominal wall permanently weakened.

Incision No. 3 (gall-bladder operations) has regard to the fibres of the external oblique, which here are perhaps the most important, and the incision separates but does not divide them. An incision skirting the margins of the ribs and following the fibres of the internal oblique is almost quite as good.

For deep operations on the ducts an additional incision (shown in dotted line) along the margin of the ribs and following the internal oblique fibres adds greatly to the space without materially weakening the wall.

No. 4, a long Langenbuch incision through the linea semilunaris, gives transperitoneal access to the kidney for certain operations; to the duodenum; and in its upper extremities to the beginning of the transverse colon. On the left side, No. 11, a shorter incision, gives access to kidney, spleen, tail of pancreas, and the splenic flexure of the colon. Langenbuch's is an excellent incision as regards freedom of access; all the flat muscles tend to draw it away from the rectus. As freedom of access is of prime importance in most of the operations done through this incision, it cannot be given up; but it should not be forgotten that this tendency of the flat muscles to cause gaping conduces to ventral hernia, and that an incision made a little inwards, and separating the fibres of the recti, greatly diminishes this risk. In this respect division of the linea semilunaris is worse than division of linea alba. Muscular action helps to close the latter incision; it makes the former gape.

No. 5 is a good incision for operations on the vermiform appendix and cæcum. It has regard to the muscular fibres and aponeurosis of the external oblique, but it divides the internal oblique and transversalis. For prevention of hernia it is not such

a good incision as one almost vertical, following the fibres of the internal oblique which are here very thick : but such an incision, in case of its being necessary to prolong it upwards, leads away from the disease ; while the other leads towards the disease. In many cases the fibres of the internal oblique and transversalis may be separated and retracted in the wound, so that no division is necessary. In resection of the cæcum the incision would have to be longer than that shown. This incision would not be good for colostomy, as it leaves the sharp edge of the oblique aponeurosis and divides the muscles which act as sphincters. If the oblique and transversalis were teased apart and the edge of the aponeurosis divided, it would do very well for colostomy.

No. 6 is a bad incision as regards weakening the abdominal wall, for it divides the aponeurosis of the external oblique at its strongest part and leaves not very strong muscular fibres behind it. No. 9 on the opposite side, a little lower down, is a better one, for it causes less division of the fibres of the aponeurosis and still keeps parallel to the fibres of the internal oblique. Both incisions are made so as to be directly over some collection of fluid in either of the broad ligaments where drainage must be carried out. The sac must be stitched to the wound ; and as such sacs are often friable and do not bear stitch-tension, it is wise to seek an opening as close as possible to the surface of the collection of fluid. A vertical incision here is the worst possible.

No. 7 is the usual time-honoured incision for operation on the ovaries and uterus. It is extremely doubtful if it is the best, as regards prevention of hernia—in fact, it is almost certain that an incision passing between the fibres of the rectus would be better in this sense. But the rectus, as a matter of fact, is nearly always exposed, and no muscular fibres being divided, the risks of hernia are here not great. As a shorter incision through the linea alba suffices than through fibres, the harm done is probably not great.

No. 8 is for operations on the bladder, and in its lower portion for division of the symphysis. Here it is not easy to separate the fibres of the rectus, and in operations such as resection or suture involving very delicate manipulations it may be necessary to

divide the rectus. This is best done close to the bone; a piece of bone may well be removed with the muscle and wired in place after operation. Where this is done an incision of this shape Λ may be made, the skin-flap being turned downwards and the muscle raised upwards.

No. 10 is a useful incision for certain operations on the descending and sigmoid colon. It may be short; for, dividing the external oblique where it is becoming aponeurotic, it gapes; by separating the parallel fibres of the internal oblique and retracting those of the transversalis, an excellent sphincteric action may be secured. This would be specially valuable in patients with thin parietes. This following of the fibres of the internal oblique will, by going behind the anterior superior spine, give an almost vertical incision. In stout patients, where it may be wise to keep nearer to the middle line, such an incision as No. 5 in the lateral view (Fig. 29) would be preferable.

Incisions 11 and 12 have already been referred to.

In Fig. 29 a lateral view of the left side of the abdomen is given. Incision No. 1 for gastrostomy is the same as No. 12 in Fig. 28. It divides fibres of the oblique and transversalis muscles, and, if the rectus is broad, some of its fibres as well. In one method of

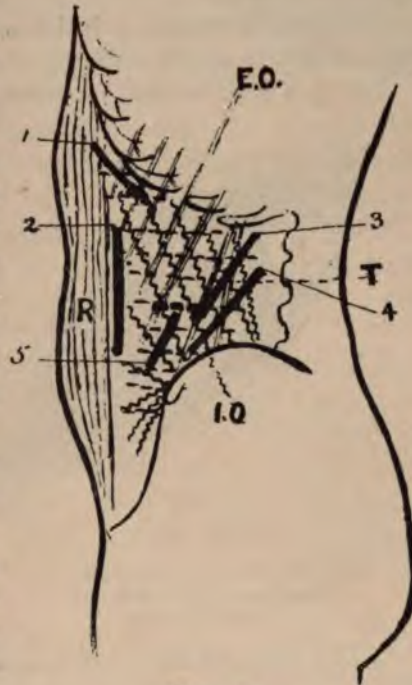


FIG. 29.

Diagram to show positions of incisions, and their relation to muscular fibres on left lateral abdominal wall.

E.O. External Oblique Muscle. I.O. Internal Oblique Muscle. T. Transversalis Muscle. 1. Incision for Gastrostomy. 2. Langenbuch's incision through left Linea Semilunaris. 3. For Nephropexy, Nephrotomy, &c. 4. For left Lumbo-Colostomy. 5. For Laparo-Colostomy.

operating, the outer fibres of the rectus, separated, are made to surround and grasp the stomach-wall drawn through the gap. (Fig. 30.) Rarely only rectus is divided, this is when the muscle is very broad; not infrequently the rectus is not seen at all, this is when it is narrow.

No. 2, the Langenbuch incision, has already been described (Nos. 4 and 11 in Fig. 28).

No. 5, a good incision for laparo-colostomy. It follows the

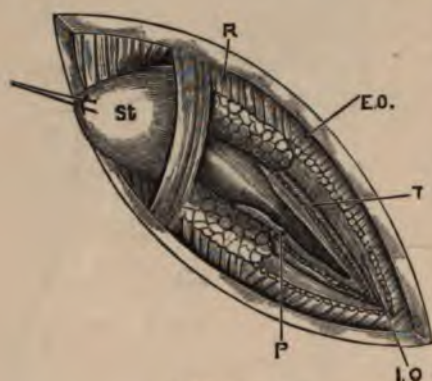


FIG. 30.

*Drawing (life-size) of the incision for
Gastrostomy (No. 1, Fig. 29;
No. 12, Fig. 28).*

R. Rectus Muscle. E.O. External Oblique Muscle.
I.O. Internal Oblique Muscle. T. Transversalis
Muscle. The lines leading to the letters are in the
direction of the muscular fibres. P. Peritoneum.
St. Stomach drawn through separated fibres of Rectus
Muscle.

fibres of the external oblique; and, as it passes diagonally through those of the internal oblique and transversalis, a small division of the fibres of these muscles, with retraction, or retraction without division at all (which is best) will provide a useful sphincteric action around the gut in the formation of artificial anus. If the aponeurosis comes far back it ought to be notched, for it is liable to close in on the gut and narrow the anal

orifice. An almost vertical incision, leaving intact the fibres of the internal oblique, is perhaps equally good for colostomy. It is not quite so convenient in operating, and I have thought the retraction of the divided oblique aponeurosis permits more ectropion of the mucous membrane of the gut. But this is a small matter.

Nos. 3 and 4, for retro-peritoneal operations on the kidney and descending colon, have no regard to direction of muscular fibre, but are planned simply to provide facility of access. The most is made of the limited costo-iliac space.

No. 3, for renal operations, goes as close up as is safe to the last rib, and as far back at the top as is convenient to avoid the thick muscles of the loin. It may divide a few fibres of the quadratus lumborum. If this incision has to be enlarged, it is best done by one running transversely across the abdomen from the lower extremity of the first incision (shown in interrupted line, Fig. 29). Such an incision divides both obliques, but leaves the transversalis.

No. 4 is the usual incision for lumbo-colostomy. It has regard simply to facility of direct access to the colon, and is determined by this and the position of iliac crest. Muscles are ignored; there is little tendency to hernia here.

Many other points might be dwelt upon in relation to each incision. But perhaps these remarks will suffice to indicate the application of the principles enunciated.

No regard whatever has been paid to the division of vessels. With the exception of the deep epigastric, there is no vessel to be encountered whose division need give us a moment's anxiety or even consideration. Forci-pressure suffices for all save the deep epigastric which requires ligature. Small muscular branches in the lumbar operation may be numerous, but rarely require ligature.

THE MAKING OF THE INCISION.

As to the making the incision in the situation selected, certain routine proceedings may be described; but the skilful surgeon will adopt a separate method for every case.

The first incision divides the skin and superficial fascia with its varying amount of fat. This, according to the position selected, will expose either dense fascial structures, as in the linea alba; the linea semilunaris or occasionally the fascia lumborum; or strong fibrous aponeurosis, as that of the external oblique muscle; or the thin fascia that covers muscles away from the strong aponeuroses; or any combination of these.

In the linea alba, unless the abdominal walls are distended and the recti separated, one or other of the rectal sheaths is

entered; and the fascial line, accurately speaking, is not divided. There is no harm in this: indeed, I think exposure of the bare fibres of one of the muscles has, on grounds described above, several advantages. This thick fibrous layer is now divided with scalpel or scissors for the whole length of the cutaneous incision. Below the fold of Douglas there is now nothing to divide but sub-peritoneal fatty tissue and peritoneum. The left forefinger is moved from top to bottom of the wound, a little of the fat pushed on one side, and the peritoneum caught by catch-forceps and pulled out. The forceps I find most convenient for this purpose is shown in Fig. 24. It is easily wriggled through the fat; it catches and holds with a very small pinch of the peritoneum, and it will not slip, in whatever direction it is pulled. The peritoneum is now pulled forwards out of the wound; another forceps is placed close to the first, and the sharp raised fold of peritoneum is sawed through by a scalpel. The smallest cut permits the air to rush in, and the bowels at once fall back. The opening is made large enough to admit the forefinger, and the peritoneum is then divided from end to end of the wound by scissors guided by the finger. A glance at the divided peritoneum will show at once whether there is any bleeding which requires forcible-pressure. Every visible bleeding point has a forceps placed on it. Hæmostasis will be complete in a few minutes, during which the forceps are left hanging over the parietes.

If the incision is made in the linea alba above Douglas's fold or above the umbilicus, and if, as is usual, one or other sheath of rectus is entered, we have to divide the united aponeuroses of the internal oblique and transversalis before reaching the sub-peritoneal fat. As to whether the umbilicus should be traversed or not in incision going above or below it, opinions are divided. On the whole, I think it is best to avoid it; by passing to the left of the umbilicus we avoid the round ligament of the liver, we introduce no necessity for complicated suturing, and we continue to have the advantage of exposed rectal muscle in the wound.

An incision in the linea semilunaris is surgically almost the same as in the linea alba. Here, however, the incision should fall towards the inside of the fascial line, because thus we minimise the

weakening of the parietes which follows. If the fascia is accurately divided, a narrow and not easily organised line of cicatrix is all that is left to counteract the tendency to gaping which the united action of the flat muscles induces. If the sheath is entered by division of the anterior layer of united aponeuroses, the muscular fibres pushed inwards, and the posterior aponeuroses divided opposite the line of the anterior, we get, if subsequent suturing is properly carried out, a broad concavo-convex apposition of surfaces which is more fully able to bear subsequent strain.

Incisions made away from superficial aponeuroses are chiefly in the upper and lateral regions of the abdomen. Whenever such an incision is made, the lines of direction of the bundles of at least two of the flat muscles or thin fascia must be divided either transversely or diagonally. Such division, if essential, should always be as limited as possible. Often, in parietes which are not very muscular, it is possible to enter the abdomen without dividing any of the fibres; by separation with the forefinger and retraction of the separated bundles sufficient space is given for many purposes. In colostomy the attempt to enter without division of muscular fibres should always be made; the fibres of at least one of the muscles should be left intact. It is always easy enough to separate the fibres with the forefinger if the division between two leading bundles is selected. In operations for appendicitis the same rule should be observed. Bleeding is very slight or absent.

CLOSING THE PARIETAL INCISION.

A great deal of attention has recently been paid to the closing of the parietal incision; the methods described are almost as varied as the descriptions. Primary healing is easily and almost universally secured by any method. Stitch abscesses result from filth, and are avoidable. Variety of method therefore arises chiefly from a desire to avoid the subsequent occurrence of ventral hernia. I have always argued that the occurrence of ventral hernia depends more on the way in which the incision is

made, than on the way in which it is sutured; and as regards the best work of the best surgeons, this is certainly true. There are only a few good methods of closing the wound; there is an endless variety of bad methods in making it.

Three leading principles may be selected for our guidance in the closing of a parietal incision.

I. *The apposition of raw surfaces should be as broad as possible.* The tensile power of a given surface of growing cicatrix may be taken as identical for every wound. The aggregate tensile power is increased in direct ratio to the surface involved; in other words, the whole binding power is greater the deeper the wound. This should lead us to be careful against drawing in or narrowing the wound surface. Where the parietes are very thin, as at the umbilicus, a deliberate out-folding of skin and peritoneum, so as to give a flange-stitch, should be made. Where the parietes are moderately thin, a judicious manipulation of the needle will bring much of the muscle and deeper tissues into the wound, and cause eversion of skin and of peritoneum when the suture is tightened.

II. *Each divided structure should be placed and kept opposite its fellow.* Thus fat should lie in contact with fat, fascia with fascia, muscle with muscle, and peritoneum with peritoneum. The wisdom of this practice is self-evident; but its importance has, I think, been exaggerated. If there were one variety of cicatricial tissue for muscle, and another for fascia, and another for areolar tissue, the accurate union of each layer would be essential. But as the young tissue is the same for all, and as each layer will certainly appropriate its own bundle of fibres from the common stock, little harm can be done if apposition is not accurate. I look upon the separate suturing of each parietal layer as a refinement always, and as a superfluity usually, provided that the single group-suture is properly placed. Sometimes it may be necessary to carry out separate suturing, in part at least: this would arise most frequently in the upper abdomen where the parietes are very thin and muscular fibres have been divided.

One objection to the suture of the separate layers is that it devascularises the lines of union and narrows them. Such a suture leaves a series of gaps to be filled with clot, between each

layer at the line of junction. (See Fig. 31, B.) There is not one flush meeting of the whole of the rawed surface as in the mass-suture. Also the cicatricial tissue dipping into these hollows is longer, therefore more easily stretched; while the bulk of it in depth not being so great, it is not so strong.

III. *The sutures should not be removed early.* We are all too fond of removing the sutures early. "Sutures removed on the seventh day" is often quoted as a proof of easy and quick convalescence. Early removal of sutures is, I think, a mistake. The good that

has undoubtedly followed the employment of buried sutures must arise, it seems to me, chiefly from the fact that we cannot remove them at the end of a week; they continue to maintain apposition for three or four weeks, or even longer.

At the end of a week the uniting medium is very easily stretched; and it is by no means strong at the end of a fortnight. A very little stretching then means a great increase of the potentiality of being stretched later. If the parts are kept together

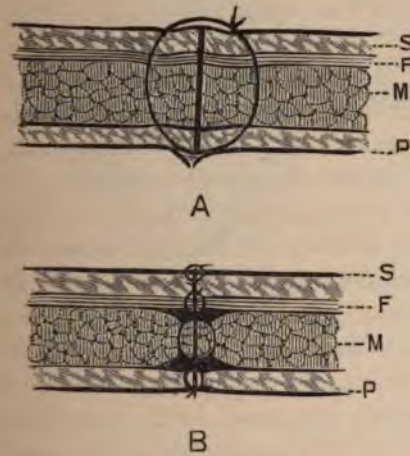


FIG. 31.

Transverse Section of Sutured Parietal Wound.

- A. Interrupted mass-suture.
- B. Continuous separate suture.
- S. Skin and sub-cutaneous tissue. F. Fascia.
- M. Muscle. P. Peritoneum.

firmly for three weeks or a month, we have done the best that we can do to prevent stretching of the cicatrix.

In the actual carrying out of these principles a suture that is not absorbent and will not act as a capillary drain upwards or downwards is essential. For the purpose Bantock's silk-worm gut stands unrivalled. It is scarcely possible to keep a row of silk sutures in an abdominal wound for three weeks without getting suppuration. Metal wire has no advantage over silk-

worm gut and has several disadvantages. The only drawback to silk-worm gut is that it is very liable at the end of three weeks to become completely buried. If the ends are kept long and occasionally pulled upon, this drawback is easily averted.

For the placing of the sutures a long curved needle with a handle is the best. It must be long if it is to include both sides of the wound. It must be curved if it is to pick up a large bundle of muscular fibre and go in and come out near the margins of the wound. And such a needle cannot be manipulated deftly if it has not a handle. A long curved Hagedorn needle with the eye at the point and set in a line with the handle is what I use and prefer to every other.

As to the actual suturing a few words may not be amiss. Firstly as to mass sutures. They are placed from two to four to the inch according to the thickness and position of the wound. A sponge laid between the wound and the bowels keeps them out of the way and absorbs the few drops of blood that escape through the punctures. The needle is inserted into the skin near to the edge of the incision; it is then made to pass outwards into the areolar tissue; it takes a good hold of any fibrous layer that overlies the muscle, then it plunges deeply into the muscle and is brought out below it. Finally it hooks up any deep fascia and picks up fibrous tissue underlying the peritoneum. *It does not pierce the peritoneum.* The needle is carried through on the opposite side in the same way in reverse order; then it is threaded and withdrawn. With a little practice with this needle the sutures may be placed with great rapidity. The depth of union sought may be regulated by the amount of areolar and muscular tissue included in the deep sutures.

When the sutures are placed, the ends are gathered together in the two hands of the assistant and the sponge removed while he pulls them forward and so brings the wound together. Then they are tied. The appearance in transverse section of a wound sutured in this way is shown in Fig. 31, A.

If buried sutures are used they are usually continuous, and they are made to include the individual layers. In Fig. 32 suture of all the layers is shown, the sutures being somewhat crowded.

Catgut carefully prepared, or ox-aorta, or kangaroo-tendon may be used. I have often used silk-worm gut as a buried suture and found it give no trouble afterwards.

An ordinary Hagedorn needle with holder does well for the placing of the continuous suture. In transverse section (Fig. 31, B) the effect of this method of suturing is shown. The muscular edge is compressed instead of broadened, and gaps are left above and below which shelter blood-clot.

A good grip of fascia should be taken, so as to bring into apposition folded surfaces and not merely cut edges.

If silk is used as suture material, plaited silk is, I think, superior to twisted. It is more compact, less absorbent, and it does not kink in the handling.

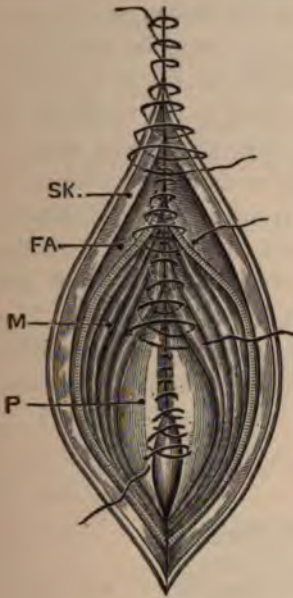


FIG. 32.

Application of Continuous Sutures to separate layers in Closing of Median Abdominal Incision.

SK. Skin. FA. Fascia. M. Muscle
P. Peritoneum.

In the introduction of silk sutures I have found my suture instrument (Fig. 33) very convenient. This instrument is essentially a handled needle, the handle of which contains a reel on which the silk is wound; it may also contain a lotion in which the thread is soaked. With this instrument sutures may be inserted with great rapidity and precision. It also saves the trouble of threading and looking after numerous needles and sutures. The handle is large enough to contain the



FIG. 33.

The Author's Suture Instrument (half-size).

ordinary trade reel of plaited silk, and the thread runs through the cavity of the handle to the top of the needle. While the bulbous end, containing the reel, lies in the hollow of the palm the tips of the fingers rest at the end near the needle, and manipulation is easy and comfortable. The needle may be inserted in the axis of the handle or at right angles to it; and various lengths of needles are employed according to the thickness of the parietes. Now that I employ silk-worm gut almost entirely for suturing the parietes, I use a needle without a reel-holder in the handle. The blade of the needle is the same—a Hagedorn with an eye at the point; it is threaded after insertion, and the suture placed during withdrawal. I often, however, find the original suture instrument with plaited silk very useful.

As germane to the subject, and as involving the principles discussed, short descriptions of operations for ventral hernia and for umbilical hernia may here be given.

Operation for Ventral Hernia.

Ventral hernia so-called is simply a stretching of scar tissue which permits the abdominal contents to escape through the parietes and to bulge outwardly under the skin. There is no narrow neck as in umbilical hernia, and no dissection of skin from parietes by burrowing omentum or intestine as in umbilical hernia. The hernial sac is simply stretched peritoneum; the coverings are stretched cicatricial tissue with a little fat and stretched skin. (Fig. 34.)

To cure this condition it is necessary to remove or push aside the redundant and attenuated tissues; and bring into contact and keep in contact the thick and non-yielding parietes.

To do this satisfactorily it is rarely necessary to enter the abdominal cavity. The areolar tissue between the skin and the peritoneum is entered by a small incision along the chief diameter of the hernia, and then, with finger and blunt director, helped occasionally by cutting, they are completely separated down to the margins of the wound. Any great superfluity of skin is

removed, but surprisingly large flaps may be left, and, if they are turned outwards or united by raw surfaces, add to the strength of the union. The peritoneal sac is turned in towards the abdomen. If very abundant it may be gathered together by a continuous purse-string suture carried through the areolar tissue, when it will form a useful pad or buffer between intestines and incision. If not very voluminous this peritoneal sac may be gathered in with the suture which closes the parietal incision, care being taken

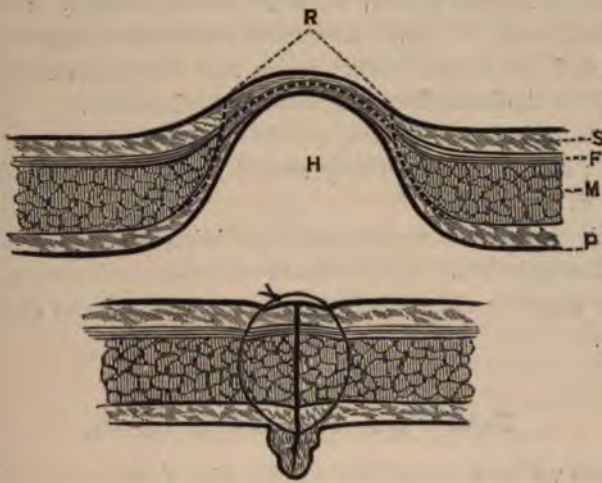


FIG. 34.

Ventral Hernia and method of Operative Cure.

The upper figure shows in transverse section the parietes involved, and the lines of incision (dotted). H. Placed in the hernial pouch. R. Skin between dotted lines to be removed. S. Skin. F. Fascia. M. Muscle. P. Peritoneum. The lower figure shows the wound after closure. Redundant skin has been removed. The intumed peritoneum is shown as a pendulous fold hanging downwards.

that each stitch takes in only areolar tissue, and that no part of the peritoneal sac is pulled between the joined parietes. (Fig. 34.)

The incision along the margins of the opening in the parietes is carried deeply into the tissues so as to expose the muscles. If it is difficult to bring muscle through this incision so as to form a flange stitch, then all cicatricial tissue should be cut clean off so as to lay bare the muscle. The parietal incision is now closed by

mass sutures which pass well back through the subcutaneous areolar tissue, take up a good bundle of muscle and a pinch of sub-peritoneal areolar tissue. If an abundance of muscle is forthcoming, fasciæ may be ignored. But if, as is too often the case, especially after an incision in the lower lateral parietes which has severed the muscles and the fascia, there is little muscle near, then we must seek out and isolate the fascia of the external oblique and bring it over the wound somehow, even if it is necessary to resect and turn over a flap. But muscle, being the best guard against hernia, should, if at all possible, be brought into the wound. It may be possible to detach a few bundles of fibre; and this should be done rather than leave the wound closed away from the immediate neighbourhood of muscle.

If there is much tension the sutures should be placed very closely; and in any case they should not be removed for three weeks or a month.

This operation is a comparatively trifling one. As it does not open the abdomen, there is none of the thirst and other sequelæ, not to mention risk, which follows exposure of the abdominal cavity.

Radical Cure of Umbilical Hernia.

Here we have to deal not merely with a distended peritoneo-cutaneous sac, but with the firm round umbilical opening with its inner ring of dense fibrous tissue; and our operation must have regard to both conditions. It is sometimes possible to deal with both in the same incision and by the same set of sutures; more frequently, however, it will be advisable to treat each separately with separate suturing.

The operation may be described in stages :—

I. Lay open the cutaneous coverings of the hernia from top to bottom. An entrance is made by a small incision over the thinnest part which overlies bowel. At such a point skin and peritoneum may lie in very close contact, and then the opening is best made by pinching up a fold and cutting it through as in entering the peritoneum. Then with scissors, guided by fore-

finger, divide the tissues up to the limits of the hernia. Omental adhesions may be avoided. As most of the superfluous cutaneous tissue will be removed, it does not matter if the line of division is not straight.

II. Return the bowel into the cavity and place a sponge between it and the umbilical opening. If the bowel is not adherent this is done easily enough. If there are adhesions, these are separated either by simple peeling or by ligation and cutting, as seems best. Adhesions on the bowel are dealt with as if they are not to be seen again; *forci-pressure* therefore is not employed on the bowel. The bowel being returned, we have done with it; the sponge in the cavity keeps it out of the way.

III. Deal with the omentum. In most cases the omentum is adherent at many points in the sac where it has opened up the subcutaneous areolar tissues; and also to overlying peritoneum. In nearly all the omentum will have increased in size in the sac. The best plan then will be at once to ligate and divide the omentum at the narrowed neck or pedicle where it passes through the umbilicus, return the stump into the abdomen, and remove the herniated omentum with the peritoneal hernial sac. The peritoneal membrane will have to be removed either bodily or by peeling: it is superfluous first to remove adherent omentum, then to remove the tissue to which the omentum is adherent; it is more workmanlike to remove both together. In ligating the omental pedicle a double transfixing and interlocking ligature of silk should be employed; and compression should be aided by pinching the line of ligature with a strong forceps. This does away with the risk of hæmorrhage from slipping of the tissues away from the ligature. The omental stump on division is pushed inside the abdomen behind the sponge, and the cavity is now permanently excluded from the field of operation.

IV. Remove superfluous skin and sac. The distal side of the stump with forceps attached is now pulled out of the wound; and the sac is thereby everted and all adhesions and attachments made visible. The amount of skin to be removed is now decided upon and the division is at once made by clean sweeps with the scissors. This in many cases will set free the omentum as well.

Adhesions in some cases are found in the deeper portion of the sac; by dragging on the omentum and using the finger or blunt dissector the sac is separated from surrounding areolar tissues

down to the circumference of the umbilical opening, and then bodily cut off with the adherent herniated omentum. It is useless to waste time in separating sac from skin where both are to be cut away; separation is begun only after superfluous tissues are removed. The peritoneal covering is now stripped off all round the umbilical opening and pushed inside the abdomen.

V. Open up the free margin of the umbilical ring so as to liberate the edges of the recti. In harmony with the principles already contended for, this is the most important single element in the operation. A deep cut (with a knife with bent blade, if neces-

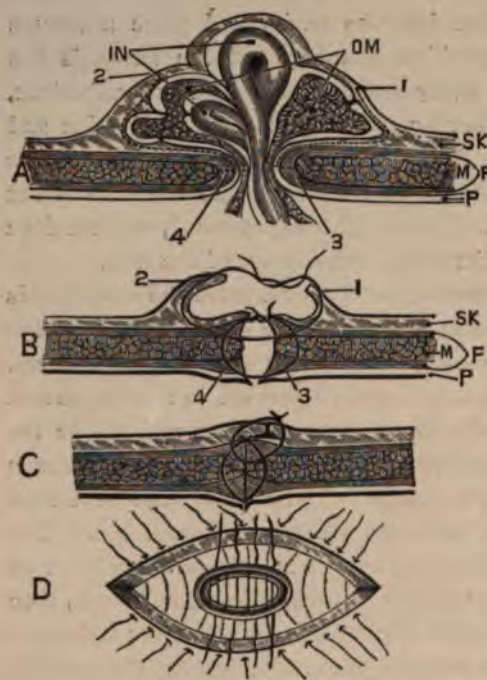


FIG. 35.

Radical Cure of Umbilical Hernia.

A. Transverse section through hernia. IN. Intestine herniated; O.M. Omentum in sac hypertrophied and adherent; SK. Skin; F. Fascia; M. Muscle; P. Peritoneum; 1 and 2 placed at the points where superfluous skin and sac are removed on the outer aspect, and where sac is detached and removed on the inner; 3 and 4 incisions down to recti through fascial surrounding of ring. The dotted lines between 1 and 3 and 2 and 4 mark the line of separation of sac.

B. Same, bowel returned. Omentum and sac removed. Superfluous tissue removed. Structures around ring opened up (3 and 4), and sutures inserted. References as in A.

C. Suturing completed.

D. Bird's-eye view (on diminished scale) of wound area with sutures inserted ready for tying.

sary) is made into the dense fibrous tissue which surrounds the ring, completely dividing it down to the muscle. The muscle

will either at once spring into the opening or will come after a little coaxing. This finishes the cutting part of the operation.

VI. Insert the sutures. For most cases it is advisable to use a double row of sutures: one deep, and dealing with the umbilical opening; the other half deep and superficial, dealing with the cutaneous and outer fascial tissues. Silk-worm gut is probably best for both. The deep sutures are inserted first through the outer edge of the divided dense fascia; then deeply into the muscle; then through the inner edge of fascia; and then through the sub-peritoneal fibrous tissue and carried through the opposite side in reverse order (Fig. 35, B, 3, 4.) From four to six interrupted sutures will be required, according to the size of the opening. When they are inserted the sponge is removed from the abdominal cavity, and they are then tied and their ends cut short. Then the cutaneous tissues are brought together. It is well if possible to bring out-lying areolar tissue into the wound and to bury the outer suture completely. The sutures pass a little way into the deep tissues between the deep sutures so as to help them (Fig. 35, B, C, D.), and are placed in half radiating fashion from the umbilicus so as to bring the whole outer wound into the smallest possible compass.

Occasionally one set of sutures may with propriety be made to serve; and I have had several successful cases done this way. But the sutures are placed with more accuracy and ease in a double row; and probably they give greater security.

The operation thus concluded is dressed in the ordinary way. The outer stitches may with advantage be left in for a fortnight or three weeks.

Intra-Abdominal Manipulations.

During the various procedures necessary for the removal of an abdominal growth, every effort must be made to protect and keep out of the way the intestines. Sponges of suitable size and shape are packed in wherever bowels appear, and the growth is isolated from the rest of the abdominal contents as far as the

available space will permit. By means of sponge-packing we seek, in fact, to make the manipulation necessary for removal as nearly extra-abdominal as possible. Wherever we can, we work against or upon sponges, and not against bowel or upon peritoneum.

Sponges not only protect delicate organs; they absorb and gather up any blood and fluid that may escape. And every spongeful of fluid so removed is a saving of time and trouble against the time when it becomes necessary to perform the final toilet of the peritoneum. Whenever a sponge appears to be saturated, it ought to be replaced by one which has been squeezed dry. Of course, it must be taken out of fluid that is warm; carbolic lotion, of the strength of two and a half per cent., is as suitable a fluid for sponges as any.

Most of the difficulties in removing abdominal tumours arise from the separation and management of adhesions. When they are visible, or within easy reach of the fingers, their separation may be comparatively easy; when they lie deep or out of sight, their division may be attended with difficulty or danger. Special difficulties arise when delicate organs are glued to thin or inflamed walls of cystic growths, or where bowels are embedded in sulci of the tumour, or where any of the large abdominal vessels or the ureters are in close contiguity. Adhesions to the omentum are, as a rule, most easily dealt with; adhesions to the bowels in the pelvis, or to the under surface of the liver or diaphragm, are amongst the most difficult of all. Tumours in the broad ligaments may require a prolonged and tedious dissection to separate them from uterus and bladder. Each case has its own variety of adhesion, which must be dealt with by methods peculiar to itself.

Forceps, sponges, fingers, scissors, and ligatures are in constant use during the surgical management of adhesions. Slight adhesions are best separated by means of a sponge; the adherent organ is sponged off the tumour, so to speak. At every step bleeding points are looked for and forceps placed on them. Adhesions of some degree of firmness, if broad, must be separated by fingers; if long or thin, or of the bulk that might be classed as bands, they are divided by scissors between pairs of catch-forceps.

Very dense, broad, and sessile adhesions are divided by scissors; while forceps or ligature, as may seem most suitable, checks the bleeding as it arises.

At the end of a difficult operation, as many as two or three dozens of catch-forceps may be clinging at points where bleeding had taken place. By many surgeons it is considered necessary to apply a ligature to each of these, and the time spent in doing so is of necessity very considerable. I have always acted upon the principles of general surgery, regarding a small bleeding point which has been effectually compressed as secured against hæmorrhage. Less than a fourth of the vessels compressed by forceps require ligature. Most of them will have been crushed; and on many of them the forceps will have been hanging for ten minutes or a quarter of an hour, so that coagulation will probably have taken place above the crushed point. I am convinced that we overdo the deligation of adhesions; I believe that perfectly trustworthy hæmostasis may, in the great majority of bleeding points left after separation of adhesions, be effected by forcipressure alone.

Protection of Viscera.

In many operations exposure of the peritoneum to the atmosphere is unavoidable; in some the intestines have to be delivered and kept outside the cavity for a prolonged period. Walthard* found that prolonged contact of normal peritoneum with atmospheric air causes necrosis of the superficial layer of endothelial cells, and results in the formation of adhesions even with asepsis. What mere exposure will do rough handling will do in a worse degree. The importance of protecting the viscera from being chilled or dried is only less than being careful to handle them with the greatest delicacy. We seek to prevent exposure by keeping the viscera inside the abdomen; and if they have to be extruded, by carefully shielding them from air and injury.

To prevent extrusion the insertion of large flat sponges under the parietes is the plan most frequently used, and is, unless the

* *Correspondenz-Blatt f. Schweiz. Aerzte.*, xxxiii., 1893.

parietal wound is very large and the patient is straining, quite efficient. For such cases Maunsell's diaphragm (Fig. 36) may be employed. This is an oblong frame, about eight inches long and four inches wide, of copper-wire covered with rubber tubing, across which several thicknesses of aseptic gauze are stretched. The diaphragm placed over the bowels inside the parietes is kept in place by two attached threads carried round the patient's body. In some cases the wound is closed at once by sutures after delivery of a tumour, and protrusion of intestines thus prevented.

When intestines lie outside the cavity and have to be kept outside for some time, they must be carefully protected against evaporation, cold and injury. To prevent their being chilled and dried by evaporation, a sheet of gutta-percha tissue should be laid over them; outside this several sponge-cloths wrung out of hot aseptic lotion will provide warmth and moisture. The finest of sponges and the softest of cloths are coarse and

irritating in contact with the delicate endothelium; the smooth rubber tissue is comparatively harmless. If bowels have to be kept outside for more than a few minutes, they should always be covered by the non-irritating, non-absorbing, and impervious gutta-percha tissue. It is possible to keep extruded intestine



FIG. 36.

Maunsell's Intestine Guard, with Handle suggested by Mr. Watson Cheyne.

smooth and free from adhesions for days if they are well protected by this tissue; unprotected, they form adhesions to incised surfaces or rough fabrics in a few hours, and are difficult to separate.

A capable assistant will see to this protection of the viscera if the surgeon is engaged in other and more serious work. He will deftly slip the tissue and cloth covering over the extruded bowels and arrange them on the parietal macintosh somewhere away from the field of operation. As the warm wet cloths get cold or dry he changes them; and this he may do several times while the proper operative work of the surgeon is going on. Nowhere is the knowledge and loyalty of a capable assistant more conspicuous than in the jealous protection of viscera from injury.

The Toilet of the Peritoneum.

Of the many good practices which Keith has introduced into abdominal surgery, not the least valuable is that of removing from the cavity all blood and escaped fluids before closing the parietal wound. Most of such foreign matter, if fluid, will be removed with the sponges placed in the cavity during operation. A final cleansing by means of a sponge held between the blades of a sponge-holder, and carried into Douglas's pouch and into each loin, may suffice. But if purulent or colloid fluids, or the contents of a dermoid cyst, or, generally, any materials which cannot easily be removed by a sponge after moderate use of it, lie in the cavity, then Tait's plan of washing out the abdomen ought to be adopted. If a tumour has been removed, and the parietes, being relaxed, can be pulled forward, the cleansing fluid may be poured in from a jug. But, for most cases, irrigation is the best mode of cleansing. If a special irrigating apparatus is not at hand, the fluid may be conducted from an ordinary basin by arranging the tubing of an ordinary trocar as a siphon.

For conducting the irrigating fluid inside the abdomen, I have had made simple glass tubes of different sizes at the nozzle,

according to the size of the stream we may wish to employ, but all of one size at the other end, so that they may fit into the large rubber tubing attached to Tait's trocar. Tait's trocar used at the end of the rubber tube has this disadvantage in cases where it is desirable to direct the stream upon a certain small area, that the fluid flows out through two openings near the point, and not through one opening at the point. Sometimes it is desirable to direct a small stream with considerable force upon a very limited area, then a small nozzle may be used and the irrigating reservoir elevated: at other times it is desirable gently to fill the cavity with a large body of water, then the largest nozzle is used with moderate elevation. The size of the stream and the force of it can thus easily be regulated.

To aid in the removal of particles of filth, the bowels are moved about by the fingers, and the abdominal walls are gently kneaded and squeezed. The amount of foreign matter, such as little clots of blood, small shreds of tissue, and pieces of coagulated fibrine, which may escape from the abdomen during irrigation, is sometimes truly surprising. A conspicuous advantage of irrigation is, that it will always make visible the existence of bleeding. A very small quantity of fresh blood makes itself apparent in water.

The residual fluid left after squeezing the parietes is removed by sponges. It is often a good practice to place a large sponge in Douglas's pouch, with forceps attached, and leave it there till the sutures are placed. Fluid is attracted to a sponge from all parts of the abdomen, except perhaps from the lumbar hollows, and sometimes it may be advisable to place sponges there also. After irrigation, elaborate sponging is not required; the fluid which remains after squeezing the parietes is quietly soaked up by the sponge or sponges left inside, while the sutures are being inserted. A few ounces of clear fluid left inside do no harm whatever; indeed, it is conceivable that under certain circumstances such fluid may do good. In several cases where I have employed irrigation, after reopening the abdomen for peritonitis following operation, I did not attempt to suck out any of the fluid, but simply let it flow away through a drainage tube. Sometimes as

much as a pint would be left inside, and very little of this would come away in the next twenty-four hours. All the patients recovered. In most cases where irrigation has been called for, a drainage tube will be inserted, and left in for at least one day.

Before the parietal wound is closed, all sponges and instruments are counted, to make sure that nothing has been left inside the cavity. Judging from the number of catastrophes which have been caused by leaving foreign bodies in the abdomen, the necessity of doing this would seem to be very real. Dr. Wilson* has collected twenty-one such cases, in most of which the foreign body was a whole sponge or part of one, and in a minority, forceps. It is a good rule always to begin operation with a fixed and definite number of sponges and instruments.

Drainage.

The wounded or irritated peritoneum secretes fluid in amount varying according to the extent of the traumatism. Sero-sanguineous oozing from raw surfaces adds to the exudations. The peritoneum, in its healthy regions, has a great power of absorption, and in most cases the fluids are absorbed as rapidly as they are secreted. But sometimes secretion is too rapid for absorption, and we then get a collection of fluid which has a tendency to gravitate into Douglas's pouch. This fluid is peculiarly liable to undergo decomposition—usually, no doubt, from septic influences introduced from the outside, but occasionally, I believe, from contamination through the coats of the large bowel. In any case, the accumulation of fluid in the pelvis after abdominal operations is a thing to be guarded against. If we have any apprehension that the amount exuded will be considerable, we ought to drain; and in any case of doubt, it is wise to drain. While bleeding is going on, the tube should not be removed; and if bleeding is apprehended, the tube should be inserted and left till the danger has passed. Whenever purulent or decomposing fluid has escaped into the abdominal cavity,

* *Trans. of American Gynec. Soc.*, vol. ix.

drainage should be employed. It is said that, the older the patient is, the less active is absorption by the peritoneum, and therefore the greater the necessity for draining. The special indications for drainage in special operations will be named further on.



FIG. 37.

Keith's Glass Drainage Tube. Half size.

The best drainage tubes for general use are Keith's modification of Koeberlé's. (Fig. 37.) They are glass tubes, open at both ends, with several perforations near the end of the tube which is inserted into the cavity, and a protruding lip near the outer extremity where it passes through the wound. The intra-abdominal pressure being greater than that of the outer air, most of the fluid will escape through any opening provided. A tube perforated through all its length may permit some of the fluid, as it rises from the pelvis, to escape amongst the bowels and, if this fluid is decomposing, to infect an amount of peritoneal surface greater than necessary.

It is necessary to be certain that the tube is pervious, and that it is in the midst of the fluid. It may become blocked by clotting of the discharges; this may be guarded against by using a syringe or suction instrument. Pieces of bowel may be drawn into the openings, and so prevent the entrance of fluid: pulling



FIG. 38.

Tail's Exhausting Syringe.

the tube out a little way, and rotating it, will put this right. The fluids may be very thick, becoming colloid or even clotted, and then it will be necessary to use an exhausting syringe. The little apparatus of Tait (Fig. 38) is very efficient for this purpose. It is essentially a rubber bag attached to the end of a piece of glass tubing. To the side of the tube is attached a glass globe, into which the extracted fluid falls; to the free extremity is attached a piece of rubber tubing, small enough to pass down the drainage tube. The tube is inserted while the bag is empty; as the bag expands, the fluids are sucked up.

In cases where there is bleeding, it is a golden rule to keep the abdomen dry. This may be done by the frequent use of the exhausting syringe—every few minutes or every few hours, according to the case. No doubt the efficacy of this plan depends

to some extent on the removal of secreted serous fluid, which would dissolve up the blood-clot. Just as bleeding is encouraged after leech-bites by the application of hot wet cloths, so it is encouraged after division of vessels in the abdominal cavity by their being bathed in abundant thin serous fluid. Keeping the abdomen dry permits clotting, and thereby promotes hæmostasis.



FIG. 39.

*Koeberlé's Glass
Drainage Tube. Half
size.*

For the drainage of simple serous fluids, a tube on the plan of Koeberlé's original one is best. This is essentially an ordinary test tube, with numerous perforations along its whole length. Koeberlé's tube is slightly conical, and this shape renders it liable to slip out of the opening: in the tube shown in the engraving (Fig. 39) the neck is the narrowest point, and escape from the cavity is thereby prevented. The bulbous end brings a larger surface of intestine into contact with it, which is perhaps an advantage. Tait has recently recommended a tube which is cylindrical, exactly like a test-tube. The rounded extremity of the tubes on Koeberlé's plan is less likely to cause perforation of the

rectum than the annular extremity of Keith's tubes. Its numerous perforations are an advantage in draining abundant fluid, and no disadvantage if the fluid is not septic. Keith's tube, on the other hand, has the enormous advantage of per-

mitting the extraction of pieces of clot, or lymph, or other aggregated material. For special cases specially shaped tubes are provided. The curved tubes of S nger, short with large calibre and flange (Fig. 40), or long, with bevelled



FIG. 40.

S nger's Curved Glass Drainage Tube.

extremity (Fig. 41), have advantages for special cases.

Drainage of fluid may be promoted by capillary action. A shred of gauze rolled up and laid in the tube, serves this purpose admirably. The free end of the roll of gauze is placed in contact with the absorbent dressing, or sponge, which is laid over the end of the tube. This simple expedient, which I have always employed inside a drainage tube, has, under the name of capillary drainage, been employed with the threads free inside the abdominal cavity as a separate and valuable method of drainage. By capillary action the abdomen can be kept continuously dry: the exhausting syringe acts only intermittently, and the fluids collect in the intervals. The chief advantage of the plan may be got by placing the threads inside the drainage tube: it adds to peritoneal irritation to let the threads lie loose inside the cavity.



FIG. 41.

Curved Glass Drainage Tube. Bevelled end.

In one class of cases this peritoneal irritation setting up a plastic peritonitis is deliberately sought for, and it is best got by the placing of gauze or other absorbent material free in the abdominal cavity. A tube of peritonitic lymph is formed round

the irritating gauze, and a channel, isolated from the general cavity, is formed between the deepest point which the gauze reaches and the outer air. For drainage of a cavity whose walls cannot be brought up to the skin, this method of drainage is of great value. One good method is shown in Fig. 42. A bag of the gauze material is made of length and capacity suitable for the case; this is filled with strips of the same material, which can be



FIG. 42.

*Capillary or Gauze Drainage.
Gauze bag containing strips of wick or gauze, and
a glass or rubber tube with threads inside.*

removed and changed as they become clogged; and inside all is placed a glass or rubber perforated tube containing a few threads to favour capillary drainage. The fluid collected by the tampon gauze is squeezed into the tube; the presence of the tube in the centre of the gauze tampon insures that increase of intra-abdominal pressure makes drainage more perfect.

The manner of collecting and removing the discharges from the drainage tube is of some importance. The end of the tube is completely isolated by a square of rubber cloth, through the centre of which a hole has been cut, large enough, with a little stretching, to encircle the tube below the collar. The absorbent material being placed over the end of the tube, the cloth is folded over it, so as to completely envelop the dressing, and the whole is retained in position by a loose binder. The dressing is changed as often as it gets nearly saturated by simply unfolding the rubber, and without disturbing the coverings of the wound. Sponges are usually employed to absorb the discharges; but the obvious objections to the use of sponges for this purpose make

me prefer absorbent wool or gauze. Sal-alembroth wool, properly prepared, is an excellent absorbing material, not so cumbersome as sponges, and is, besides, a powerful antiseptic. A folded sponge-cloth wrung out of 1—30 carbolic lotion and changed as often as may be necessary is a simple and efficient absorbent dressing.

Dressings.

In a few hours after operation the peritoneal surfaces will have united, and the parietal wound will then be, to all intents and purposes, a superficial one. It matters very little what the dressing is, if it is unirritating and absorbent. A pad of alembroth wool, or salicylic silk, or carbolised gauze, or a few folds of boracic lint, will serve the purpose admirably. The dressing need not be disturbed for a week, when the wound will be found quite healed. On the dressing, when removed, we expect to find a thin layer of dried sero-sanguinolent discharge, two inches broad.

If septic material, such as the contents of a putrid abscess, has come into contact with the skin surrounding the wound, or if an operation has to be done on short notice before the skin can be efficiently cleansed, then extra precautions are advisable. I am in the habit of sprinkling powdered boric acid around the wound and rubbing it into the skin and hair follicles with my finger dipped in strong carbolic lotion. The carbolic acid seems at once to dissolve up the boric acid, which re-crystallises in the sulci and cracks of the skin, and acts both as a mechanical plugging and as an active antiseptic. In all doubtful cases safety is probably best secured by frequent dressing and washing the cutaneous surfaces all round with antiseptic lotion.

Kelly* has endeavoured to solve the problem of an "ideal dressing for the abdominal wound"—"a dressing (that is) which hermetically seals the wound in a thin layer, with certainty preventing the invasion of pathogenic organisms from without"—as follows:—"After closure of the incision the skin, the line of the

* *Amer. Journ. Obstet.*, 1890, xxiv., 12.

wound, and the sutures are dried, and two layers of sterilised gauze or cheese-cloth, large enough to project from two to four inches beyond the incision on all sides, laid on the skin. This is saturated with the following adhesive mixture, which is evenly distributed over the whole surface :

Squibb's ether or washed ether and absolute alcohol, equal parts.

Bichloride of mercury, enough to make the solution $\frac{1}{1000}$.

Snowy cotton (Anthony's), enough to make a syrupy consistence, added in small pieces, stirring.

As soon as this is poured over the wound evaporation takes place, and the celluloidin hardens, gumming the gauze fast to the skin. To avoid delay in waiting for this to grow quite hard, and to prevent adhesion to the cotton applied above it, the whole surface is freely dusted over with a finely powdered mixture of iodoform (one part) and boric acid (seven parts). The wound thus sealed with celluloidin may be left untouched for a week or more, when the dressing should be softened with water, or more rapidly with ether, the gauze lifted off and the stitches taken out."

After removal of a large tumour, I think the plan of covering the whole abdomen with long broad layers of strapping should be adopted. The sudden decrease of abdominal tension that follows removal of an abdominal tumour no doubt favours gaseous distension of the bowels; and strapping is undoubtedly a better means of preventing this than a tight binder. The strips of plaster act as a firm unyielding splint, keeping the parts immovable, and permitting the patient whatever liberty of movement she may desire. Not only are changes of position from the back to the side very agreeable to the patient; but lying on the side, with the knees drawn up, favours the passage of flatus and the use of the rectum-tube. Hollows under the strapping are to be filled up by firm pads of some sort; folded towels do very well. A binder is unnecessary.

If drainage is used, the dressing and strapping stop short at the point where the tube emerges. Special dressings are arranged around the end of the tube in the manner already described (p. 129). The most scrupulous attention ought to be

paid to the securing of perfect cleanliness in the means adopted for collecting discharges from the abdomen.

Stitch-abscesses, causing some elevation of temperature, are mentioned as possible accidents during the uniting of the parietal wound. Those are never seen in wounds treated antiseptically, and I think they can be caused only by the use of sutures which are not absolutely free from filth. Perhaps too much tension in the stitches might cause suppuration in their track; but if everything were aseptic, this would not cause elevation of temperature.

In the manipulative part of the operation, absolute precision and exactitude, as far as hands and materials can secure these, are necessary to the most perfect success. Not only must no part of the work be hurried over or scamped, but every detail must be finished and rounded off with a thoroughness as minute and genuine as if that detail were the turning point of success. And, practically, it is a fact that imperfect attention to almost any detail may result in a catastrophe.

But the avoidance of bungling, oversight, or neglect is not enough. It is possible to overdo, as well as to underdo. The clamp is an example of overdoing, and the calamities that followed its use are our warning. We may run to excess in the means adopted for stemming hæmorrhage, by means other than the clamp. We see this in the double, triple, or even quadruple ligation of the most ordinary pedicles by certain operators; in an elaborate sponging of the peritoneal cavity that is prolonged beyond cleansing into irritation; in separate suturing of peritoneal surfaces; and in many other ways that could be mentioned.

It must not be forgotten that shock is one of the chief dangers in all abdominal operations, and that tardiness in operating is an important factor in contributing thereto. In addition to the risk from extended traumatism, we must reckon with that from prolonged anæsthesia. These propositions have only to be stated, to be admitted; but not all who admit them act upon them. Rapidity in operating is a prime virtue in

abdominal surgery; but this rapidity must specially be cultivated over the more subsidiary details, as in making the parietal wound and closing it. In other matters no time must be spent in deliberating. The surgeon must be prepared with mind, hand, and instrument to meet every emergency as it arises according to the best rules of his art. A man who enters the abdominal cavity ought to be able to do anything, from ligature of a vessel to resection of the intestine; and he should be prepared to do this in a manner which defies the criticism of his brethren. We can rarely diagnose perfectly the state of matters inside an abdomen before we open it, and we ought therefore to be able to treat anything which we find when we enter. Dexterity here comes from knowledge as much as from practice.

To be prepared, at the appearance of any complication, to apply the best known surgical technics; to do what is wanted, and no more than is wanted; to have the manner and method of each procedure mentally laid down in clear and definite lines; and generally to perform the operation in steady, straightforward, workmanlike manner through the endless complications that may arise, is no trifling call on the capacities of a human being. Much of it may be learnt by intelligent practice, at the expense of the patients; much may be learnt by careful study and practice on the dead body; but most of all will the young surgeon derive information from a close and intelligent personal attendance at the operations of our great masters. Abdominal surgery is no longer a field for legitimate and versatile experiment; certain fixed and useful laws and customs have been laid down by the dearly bought experience of great men: the abdominal surgeon ought to begin fully equipped with such knowledge as has been gathered for him.

After-Treatment of Cases of Abdominal Operation.

Comfort.

Food and Drink.

Thirst.

Functions of Bladder.

Shock.

Vomiting.

Tympanites.

Peritonitis.

Rectal Feeding.

Pyrexia.

A golden rule in the treatment of cases of cœliotomy is—to let the patient alone. Everything approaching to meddling is to be condemned. The patient must not be upset by fussy applications of tentative therapeutics: when an emergency arises, it is to be met, promptly and decisively, by a method which has been approved trustworthy.

Comfort may be regarded as a therapeutic measure of some importance. Besides the ordinary measures that would be adopted with a patient who is seriously ill, certain minor attentions in abdominal cases may be carried out with benefit. The luxury of a change into a second bed, with clean fresh linen, will be highly appreciated, and will often be a means of securing a good night's rest. Changes of position—moving the patient from back to side, raising the head and shoulders a little, bending the knees over pillows, or raising the lower limbs on supports—all tend to lessen the irksomeness of confinement to bed, and by so much to increase the chances of recovery. Sponging the arms, legs, and chest, or washing them with soap and warm water, will always be grateful. These and similar proceedings are well worthy of consideration, as being items in the not inconsiderable total of the patient's comfort.

As to the administration of *food* and *drink* to the patient, it is impossible to give definite rules. Generally speaking, the

gravity of the case, and our apprehension of danger, will be our guides. A simple case of oöphorectomy or ovariectomy, after the first twenty-four hours, will require little change from the ordinary diet of health. In cases of serious operation, where some degree of inflammation of injured viscera is bound to supervene, dieting may be of supreme importance. In such cases irritability or paralysis of the whole digestive tract, with vomiting and tympanites, may co-exist with an urgent necessity for supporting the patient's strength by stimulating nourishment. The judicious management of these cases will tax the surgeon's capacity to the utmost.

Thirst is the first complaint of the patient in almost every operation in which the peritoneal cavity is opened. If we fully understood the explanation of this fact, we should probably be better able to meet it therapeutically. Many surgeons advise complete abstinence from drink as well as food for the first twenty-four or even forty-eight hours. Martin, in his excellent monograph on the "After-treatment of Cases of Abdominal Section,"* insists on the wisdom of total abstinence from fluids for forty-eight hours after operation. The patient, he says, "suffers cruelly from thirst," but the surgeon "must not give way to the patient's appeals."

I cannot subscribe to this view. There is no need to make the patient "suffer cruelly from thirst"; total abstinence from fluids for forty-eight or even four hours is, in my belief, quite unnecessary. If there is much shock and the stomach is likely to be inert, water should be administered by enema almost immediately after operation. From four to twenty ounces of tepid water, with some brandy or beef-jelly, gently passed into the rectum allays thirst and stimulates the patient. In three or four hours sips of hot water or weak tea or toast-water may be given by the mouth; and in from twelve to twenty-four hours some liquid nourishment may be given by the mouth as well. Cold water and particularly "ice to suck" for thirst are to be avoided; they do not allay thirst as well as warm fluids, though they are more grateful in the mouth; and they lie in the stomach to be

* Lond., 1894, p. 5.

ultimately rejected. In every case it is unwise to upset the functional capacities of the stomach by giving large quantities of fluid to allay thirst, when a rectal injection of warm water will produce the desired result. But deliberate withholding of all fluids, and the consequent entailment of suffering and restlessness, is, I believe, to err as far in the other direction.

In general, milk is a bad food for abdominal cases. It is not digested by the stomach; and, as curd, it may pass a long way down the intestine; also, it is a food that causes flatulence. Peptonised milk has not these drawbacks, but patients rarely like it. Good home-made beef-tea, or any of the numerous concentrated beef jellies, taken either solid in tea-spoonfuls at a time, or much diluted if the patient is thirsty, are usually agreeable to the patient, and are of great value. Oatmeal gruel and liquid arrowroot, with similar articles of diet, varied according to the patient's taste, may be given. I have found peptonised milk and cocoa a good food in abdominal surgery.

"Little and often" is to be the rule of administration; but not too little nor too often. The stomach, like other organs, wants occasional rest; and to keep it in constant action for three or four days on end by hourly or half-hourly exhibitions of small quantities of nourishment, will result in functional irritation, or even exhaustion of the organ. The peculiarities of the case, and the tolerance of the stomach, must direct us. In all cases we must not forget that foods when peptonised may be retained and absorbed, when they would be rejected in their unprepared condition.

In operations upon females, special attention must be paid to the management of the *functions of the bladder*. It used to be considered necessary to draw off the water by catheter at frequent and stated intervals for some days after operation. This is quite unnecessary. The catheter need not be passed till the patient feels a desire to micturate; and as soon as she can pass water herself, she may be permitted to do so. Many patients do not require the use of the catheter at all.

The secretion of urine is diminished after abdominal operations, and continues abnormally low for from a week to ten days.

Penrose,* in 111 cases of coeliotomy, gives the average secretion of urine in the first twenty-four hours as 13.4 ounces; in the second as 14.6 ounces; in the third as 19.6 ounces. Accurate measurements taken in a consecutive series of twenty-eight operations of my own gave for the first twenty-four hours 17.7 ounces of urine; for the second, 23.9 ounces; for the third, 26.2 ounces; for the fifth, 27.7; and it was not till the eleventh day that 38 ounces were secreted, this remaining the average amount till the patient got out of bed. No harm will result, therefore, if the urine is not drawn off at all on the first day; and twice on the second day, and thrice on the third and subsequent days, will probably be found sufficient.

Cystitis, often of a troublesome nature and continuing over many days, may be produced by catheterism. It rarely appears till a week or even longer after the use of the catheter has been begun. Its cause is filth introduced by the catheter. To avoid this the orifice of the urethra should be cleansed, and the catheter should be above suspicion. I have come to the conclusion that a metallic catheter which can be purified by boiling is the safest; aluminium is probably the most durable and serviceable metal, and it has the further advantage of bearing purification in the spirit flame. In the treatment of catheter-cystitis, I know nothing better than irrigation with a solution of boro-glyceride of strength one ounce to the pint.

The above account refers to the management of simple straightforward cases which proceed easily and rapidly towards recovery. But sometimes we have to deal with conditions which are partly outcomes of gravity of operation, and partly special to abdominal cases. Among the former we may reckon shock or collapse, restlessness, and pain; among the latter, vomiting, tympanitic distension, and peritonitis.

Severe *shock* after operation is treated on ordinary surgical principles by hot bottles, hot blankets, stimulating applications to the epigastrium, elevation of limbs, and so forth. Surrounding the limbs in packs wrung out of hot water has often an excellent

* *Ann. of Surg.* 1895, xxvi., p. 184.

effect. Hypodermic injections of ether, ammonia, or brandy, and rectal injections of diffusive and alcoholic stimulants, are frequently administered. Gill Wylie* speaks highly of the value of irrigation of the cavity with hot water (105°—110° Fah.) as preventive of shock; and others have borne testimony to the same effect. Restlessness and jactitation must be treated by a hypodermic injection of a quarter of a grain of morphia, to be followed in an hour by a sixth of a grain or more, according to the effect of the first dose. Morphia is not to be used unless there is strong necessity for it. It lowers the functional activity of the intestines, and favours the production of tympanites—an effect which is specially to be avoided. The patient is to be encouraged to bear the pain: it rarely lasts for a long time; and it will be better for her, in the event of further troubles arising, that she should meet them with a system unimpregnated with morphia. The routine employment of morphia is to be condemned. The patient is always brighter and better without it, if there is no urgent call for its exhibition.

In grave cases it is wise to begin at once feeding by the rectum in the manner to be described. Collapse is a cause of vomiting; and want of food and stimulants for the customary twenty-four hours may encourage the very symptoms we wish to ward off. Free stimulation by brandy or other spirit, administered in enema, during the first day or two after a very serious operation on a weak patient, is a therapeutic measure of supreme value. In many cases a glass of hot spirit and water, taken the last thing at night, will act as a soporific.

Vomiting is perhaps the most troublesome single symptom that we have to deal with after abdominal operations. Arising soon after operation, and lasting over ten or twenty hours, it may be nothing more than an effect of the anæsthetic. When it exists on the third or fourth day, and continues, we may conclude that it indicates peritonitis or enteritis, or some allied inflammatory condition, which causes paralysis of the functions of the bowels. In this case we must take prompt measures to deal with events which may have grave issues.

* *N. Y. Med. Rec.*, March 19th, 1887.

The vomiting, in this case, is not of the sort that can be controlled by medicine. Indeed, it is more than doubtful if it is desirable to seek to control it. It is almost uniformly accompanied by distension of the bowels with gas and fluid, and vomiting affords relief. It is certainly not wise to let the patient continue feeling sick and vomiting frequently small quantities at a time; but it may be wise to encourage free vomiting for a few minutes together. I have found that the administration of as much fluid as the patient will drink—soda-water, or weak tea, or simple warm water—is followed by the evacuation of large quantities of bilious fluid and gas, and makes the patient comfortable for some hours. In more than one bad case, I have found Kussmaul's treatment of washing out the stomach by the stomach pump of conspicuous benefit.

The indication is rather to remove the cause of the vomiting, than to check it when it has set in. For this end, we must at once stop the administration of everything by the mouth, and support the patient entirely by rectal feeding. By lying on the side, and wearing the rectum tube as much as possible, the passage of flatus downwards is encouraged. And at least once a day, large quantities of warm water, with a little turpentine, are injected into the rectum, so as to completely remove whatever gas may be in the large bowel, and encourage more of it to descend from the small bowel.

Tympanites. Pseudo-ileus. Peritonitis.—A certain amount of gaseous distension of the intestines follows most abdominal operations; when distension is excessive, actual obstruction (as will be explained under Intestinal Obstruction) is induced—this is known as Pseudo-ileus: peritonitis is always followed by gaseous distension of the intestines and usually by obstruction. The clinical signs of all the conditions merge or overlap; therefore, though the pathological features are different, it will be convenient here to consider these conditions together.

Some years ago I satisfied myself, after sundry experiments, that intestinal over-distension by kinking of the bowels and paralysis of the intestinal muscle, was a cause of true obstruction,

and I began to prescribe purges with the view of stimulating the intestines to contract and evacuate themselves. The results were beyond expectation gratifying; and when I found that this practice had for some time been a routine treatment in Tait's practice, I had no hesitation in extending it. These cases were spoken of as peritonitis in the early stage; and the treatment of peritonitis by purgatives, as against its treatment by opium, was discussed in many papers. Now it is necessary to modify this view. We seek to distinguish between true peritonitis and simple parietic ileus; purgation is said to be useful for the one and not for the other. It is difficult to see how this can be proved. All are agreed that the early stages of peritonitis are clinically indistinguishable from pseudo-ileus. If a purge is given and the symptoms disappear, who shall say which it was?

This is reasoning on an unproved assumption. It also makes a postulate which is not proved, and which necessitates a change in definition. It assumes that there is no peritonitis which is not septic, and concludes that therefore no peritonitis is improved by purging. If we deny that the synovitis which follows a blow is inflammatory, we may deny that the peritonitis which follows operation is inflammatory; but we must change our definition of inflammation if we do so. If we believe that there is no inflammation which is not caused by germs, then the employment of purgatives has at best a doubtful value. If, on the other hand, we believe that it is inflammation which we see when we put a drop of vinegar on the mesentery of the frog, then purgatives may by depletion be valuable. Lastly, if we hold that, peritonitis or no peritonitis, the oncome of flatulent distension indicating paresis of intestinal muscle is a symptom of danger which can be removed by purgation, then we ought to employ purgation. This is the position I assume.

In ordinary parietic ileus a Seidlitz powder or a calomel and colocynth pill will act like a charm and put an altogether new complexion on the case. Over and over again have I been able to demonstrate to students and medical men the value of a purge in such cases. A case seen with distension, sickness and restlessness at one visit has a purge prescribed, to be followed by a

turpentine enema; and at the next visit it is almost taken for granted that the patient will have a flat abdomen, the sickness will have disappeared, and the patient will express herself as feeling infinitely better, even if feeling weak from the exertion of passing motions. Food is now tolerated and the patient is practically out of danger.

The therapeutic value of purges in this condition, which used to be known as operation-peritonitis, is now one of the best assured facts in surgery. In the early editions of this work I spoke of purgation with cautious approval; in the preceding edition I quoted well-known authorities in its favour and urged it strongly; further experience is almost unanimous in its favour.

It is said by some that in septic peritonitis purgation is useless. I doubt this. Free purgation depletes vessels and causes absorption of peritoneal fluids; deprivation of fluids means starvation of germs. Also a non-distended gut and an uncompressed peritoneum are physiologically active, and they can dispose of noxious matters; purgation provides both conditions. Septic or non-septic, traumatic or paralytic, there is abundance of proof to show that intestinal purgation is the best known treatment for the distension which supervenes on abdominal operations. Clinically, after an abdominal operation, we may as a rule infer that if the infra-sternal depression is present, and if the parietes there are lax, matters are progressing favourably. No single fact is of more importance in prognosis than this.

Tapping with a fine trocar has been employed in cases of distension of the intestines, and it may give temporary relief; but this relief is so slight and so evanescent as to be practically of no account. Speaking from a personal experience of six cases, and from the observation of several more in the practice of colleagues and friends, I would characterise tapping of the bowels for tympanites as a simple trifling with the complaint, and as a dangerous trifling.* More advantage will be derived from encouraging free

* See, on this subject, Ogle, *Lancet*, July 16th and 23rd, 1887. In cases of tympany occurring in cattle, the part punctured is not the bowel, as Dr. Ogle seems to suppose, but the rumen or paunch. Not only in this respect but in others, such as the thickness of the visceral walls, and the nature of the contents, the analogy between human beings and cattle is not correct.

vomiting in the manner indicated above, and by large fluid rectal injections, supplemented, where it is considered advisable, by a saline purge. Spirits of peppermint, ether, or chloroform, facilitate the eructation of gas, and may be of some benefit.

A most valuable adjuvant in the treatment of distension after abdominal operations is the employment of the *rectum tube*. The vaginal tube supplied with a Higginson's syringe, or an ordinary lithotomy tube, answer the purpose perfectly well. But sometimes a longer tube, such as that used for washing out the stomach, will be required. If there is fluid in the rectum, such as remains of enemas or liquid fæces, then the long tube should be employed to carry the discharge well away from the patient's body, or a piece of rubber tubing should be attached to the ordinary tube, and carried outside the bedclothes. As soon as there is a collection of gas in the bowel which the patient cannot pass, the rectum tube should be inserted and left in position. When there is much distension, the tube should literally be worn for as long periods as possible consistently with the administration and retention of enemas. The patient very soon appreciates the virtues of the rectum tube, and frequently will ask that it be inserted.

The trinity of peritonitis, tympanites, and vomiting are the furies of abdominal surgery. When they have taken firm hold of a case, we may make up our minds for a fierce struggle before they can be ousted. The longer they abide, the more difficult are they to be got rid of; therefore, we ought to be prepared at every point to meet them with the most trustworthy weapons and the most approved tactics.

Rectal Feeding.—The frequent necessity, in abdominal cases, of feeding by the rectum demands a practical familiarity with the best modes of preparing the food, and the best means of administering it. I have closely followed the accounts of modern improvements in the artificial digestion of foods, and have specially taken note of the results found from introducing these into the system by rectal absorption. Most of the plans recommended I have either tried or seen tried in practice. Now, it is of supreme importance that feeding by rectum shall produce

a maximum of result with a minimum of disturbance. The worry of rectal feeding must be counterbalanced by very definite and palpable results; it must be something very much more than an interesting physiological experiment.

I have come to the conclusion that all rectal foods ought to possess two qualifications—namely, that they should be peptonised, and that they should be very dilute. It is idle to argue that enemas are not nutritive unless they are peptonised; long and extensive experience has abundantly proved the contrary. But it seems fairly well established that digested food is more readily absorbed by the mucous membrane of the bowel than undigested food, and is possessed of a higher nutritive value. The nutritive value of dried bullock's blood, or any of the nutritive boluses or capsules which are now prepared by various chemists, is no doubt considerable. But, for the treatment of abdominal cases at least, I believe that the best results are got from enemas that are dilute.

It is just possible that the benefits of dilute enemas may, to some extent, be accounted for by the relief to thirst which they give. Thirst is undoubtedly a frequent complaint in abdominal cases; and in such as have vomiting, the thirst is often trying. No doubt the fluids of the blood are largely drawn upon to provide the intestinal fluids which are secreted so abundantly; but the feeling of thirst may also be partly accounted for, as analogous to the thirst which is felt after shock or fainting. However it is explained, there is no doubt that the feeling removed by the use of liquid enemas, when drinking of fluids may be ineffectual. On the other hand, as regards the supply of nourishment, enemas are not, in operation cases, usually administered because the patient is famished for want of food, but because we wish to provide temporary support, to enable the patient to tide over a few days of exhausting sickness. Only in the case of gastrostomy for stricture of the œsophagus have we to combat real hunger; in other operations, it is temporary support or stimulation which we seek to provide. Prof. Bauer* insists that by the help of nutrient enemas, however prepared, it is

* Von Ziemssen's *Handbook of General Therapeutics*, vol. i., p. 266.

impossible to effect the absorption of more than a fourth part of the nourishment necessary for subsistence. This tells in favour of the exhibition of stimulants in the enemata, which undoubtedly are absorbed.

Now, in practice these principles may be carried out in two ways—either by the administration of enemata that are very dilute, and therefore in considerable bulk, or by the administration four or five times in the twenty-four hours of small concentrated bulks of food, with, once a day, the ingestion of a considerable quantity of tepid water. Some patients will, without discomfort, retain a pint of fluid in the large bowel; these I should feed with dilute peptonised enemata. A few can retain no more than four or six ounces; these I should feed with concentrated or solid peptonised materials, supplemented by the administration, once or twice daily, of a pint or more of warm water.

Pyrexia.—A few surgeons consider it necessary to make special provision for the treatment of excessive pyrexia occurring after abdominal operations. Nothing perhaps is more remarkable in the whole range of practical surgery than the slight amount of febrile reaction which is observed after abdominal operations. Case after case occurs in which the maximum temperature does not reach 100° Fah.; in fact, a temperature of 100° may be considered as abnormally high. It is also true that the greatest dangers after cœliotomy are not associated with severe pyrexia. Peritonitis of the most virulent sort may co-exist with a normal or even sub-normal temperature; and ordinary peritonitis, mild or local, rarely causes great elevation of temperature. Pyrexia after cœliotomy is not of the nature of the pyrexia in specific diseases such as typhoid fever: it does not continue for weeks together, and it is not at all likely to cause danger from mere continuance of excessive fever heat. It is probably true that cœliotomy involves a likelihood of rapid and dangerous rise in temperature no more than any other major surgical operation; and this likelihood must be exceedingly small. In the unrivalled experiences of Tait and Keith, such dangerous rises of temperature have not occurred; and it may reasonably be argued that, in the practice of others, no special preparations need be made to meet them.

In the Samaritan Hospital, the ice-cap is kept in reserve, and frequently used for the treatment of rises in temperature. Cold packs on the limbs are used for the same end. And in America a few surgeons speak of the value of Kibbee's fever cot, which is essentially a water-bed, through which cold water can be passed, so as to abstract heat from the body with which it is in contact. If I had to deal with a temperature above 104° lasting for more than two hours, I should administer a full dose of an anti-pyretic drug, and possibly supplement it with sponging of the cutaneous surface. Under 104° , I should adopt no special treatment to reduce the temperature; the strong probability is, that it will soon drop of its own accord.

COMPLICATIONS FOLLOWING ABDOMINAL OPERATIONS.

Parotitis.

Œdema of Legs.

Fistula.

Ventral Hernia.

Intestinal Obstruction.

Parotitis.—Goodell, Stephen Paget, and others have called attention to the fact that after abdominal injuries and operations a small proportion of cases is attacked with inflammation of the parotid gland, which may or may not proceed to suppuration. The explanation of this fact has been supposed to be due to the sympathy between the parotid gland and the ovaries. But the disease has been found in connection with abdominal operations not concerned with the sexual organs. S. Paget* has collected upwards of 100 cases of parotitis following injury or disease of the abdominal or pelvic organs, and due, not to pyæmia, but to reflex nervous action. The treatment is carried out on ordinary surgical principles.

Œdema of the Legs.—A small number of cases are complicated with the occurrence, during the second week usually, of a sort of white leg, accompanied by slight rise of temperature. The

* *Brit. Med. Journ.*, 1892, I., p. 815.

condition is usually free from danger, and may be treated successfully by simple elevation and systematic bandaging of the limb over cotton wool. Most cases could doubtless be explained by some traumatism or compression of a venous trunk in the pelvis by forceps or ligature; a few might arise from pelvic cellulitis or angelo-leucitis.

Fistula, simple or fæcal, is occasionally met with as a sequence of abdominal section; and, as might be expected, in the worst examples of the operation. The drainage tube is no doubt accountable for the formation of some simple fistulæ; but thick pieces of knotted silk probably account for most. Pressure-necrosis by forceps or drainage tube might produce fæcal fistula, and severe traumatism or simple tearing might have the same effect. These are causes which are not easily avoided, although they should be guarded against. But the manufacture of fistulæ through the employment of silk ligatures which are either too thick or too long, or insufficiently embedded, can and ought to be avoided.

Fæcal fistulæ frequently close spontaneously; the worst cases may require treatment by operation, such as is described further on. Fistulous tracks caused by unabsorbed ligatures are perhaps best left to the chances (favourable mostly) of spontaneous healing. But these cases sometimes continue for years to cause much discomfort and worry: then it may be advisable to seek for the offending body. A fistula is a poor anticlimax to a grand performance; the best that can be said of it is, that it is often an error arising from an excessive seeking for safety.

Ventral Hernia.—This is a more frequent sequence of abdominal section than surgeons generally know of or admit. The fifteen per cent. that were found in a special examination of a single surgeon's operations for removal of the appendages, where the incision was short and the parietes were not stretched, would probably be under the average for all operations extending back many years. The hernia is usually late in appearance, and the surgeon who operated may know nothing of it. That it occurs in twenty per cent. of all cases operated upon five years and upwards, I believe to be a fact; but we have no figures to prove it.

In the meantime, we ought to adopt the best known means of avoiding the complication.

The tough, unyielding aponeurosis of the linea alba once divided, can never be replaced. The cicatricial tissue which fills the gap is comparatively soft and ductile. By securing the greatest possible breadth of uniting surfaces the greatest amount of new tissue is got, and thereby the strength of union is increased. Skin to skin, fascia to fascia, muscle to muscle, the suture piercing and holding each in apposition, should be the rule. United thus, the wound should be pouting, and not puckered; it should form an outstanding ridge, and not a depressed groove. It should suggest union by a sort of flange-stitch, in which the raw surfaces are purposely increased in area. And it must not be forgotten that the best possible barrier against visceral protrusion is healthy, vigorous muscle. Although, for other reasons, I should not advocate an intentional departure from the middle line in cœliotomy for ordinary purposes; yet an unintentional deviation to one side or the other, necessitating an entrance through separated muscular fibres, has, in my opinion, a compensating advantage in the more certain avoidance of subsequent hernia. Giving up an abdominal support before the adhesions are firm, is just as bad as wearing it too long and causing atrophy of the muscular walls.

The treatment of ventral hernia is considered under the "Surgery of the Parietes" (p. 14).

Intestinal Obstruction following Abdominal Operations.—Intestinal obstruction as a direct result of cœliotomy may be caused in two ways. One, the result of intestinal paresis following simple traumatism, or sepsis, or a combination of these, has already been considered in the general section treating of after-progress. The other, depending on mechanical causes, will be considered here.

From the reports of Spencer Wells, Fritsch, Klotz, and others, we may conclude that about two per cent. of all deaths after cœliotomy are due to true intestinal obstruction. Rohé,*

* *Amer. Journ. Obstet.*, Oct., 1894, p. 465.

after a most careful study of the condition, would place the mortality higher than this. It is impossible to give exact figures, but it is certain that, as a death-factor, it is one of the most dangerous we have now to deal with.

Mechanical obstruction after cœliotomy may be caused in various ways. The most important is where intestine becomes adherent to a fixed surface which is denuded of peritoneum, and is thereby rendered immobile and is kinked. The stump left after ovariectomy or removal of the uterine appendages is the most common source of the trouble; but a surface uncovered by peritoneum anywhere, as at the abdominal incision, or anywhere on the parietes or in the lower pelvis after kolpo-hysterectomy, may suffice. Removal of the uterine appendages for myoma would seem to have an undue proportion of deaths from obstruction through adhesion of gut to pedicle. In such a case the pedicle would probably be in a hollow between parietes and tumour in which bowel rests, and is easily wedged and caught while adhesions form. The attachment of the gut is usually on its free surface, and obstruction is induced by traction producing acute flexure of the bowel with consequent blocking of the lumen. Naturally the most dangerous attachment is at the greatest distance from the attachment of the mesentery.

Adhesion of bowels amongst themselves is given as a cause of obstruction; but such adhesion will usually be re-inforced by bending of the gut over the brim of the pelvis, or over an omentum whose free margin has become fixed.

A third variety is simply traumatic, directly resulting from operation, and includes those cases where a knuckle of bowel is caught in a ligature, or is attached to tissue which a ligature encircles and fixes. Gut has been caught in the pedicle-ligature of an ovarian tumour, and under the wire constricting a uterine pedicle. A knuckle of bowel caught in a suture closing the parietal incision has caused a considerable number of deaths, some by strangulation, but most by kinking.

Other varieties of obstruction are from volvulus, and from constriction through a hole in the omentum or mesentery.

Symptoms and Diagnosis.—The symptoms in such cases are

easily distinguished from those following ordinary operative ileus as a result of intestinal paresis. Usually they come on later. Progress for the first three days may be of the usual nature; the rectum tube may have removed gas, but no proper action of the bowels has followed the turpentine or soap enema. In an ordinary case of traumatic ileus the free passage of gas on the second and third day will be followed by free evacuation after enema on the third or fourth day, and the trouble is over. In true obstruction relief is probably not perfect at any time; and distension rapidly increases after the fourth day. This distension is the most striking single feature. Vomiting and collapse are also present; but are not so alarming as in the septic peritonitis which we might expect to be present with such symptoms on the fourth day. The case altogether strikes the experienced surgeon as traumatic rather than septic or parietic.

Some weight has been placed on the presence of indican in the urine as a proof of obstruction of the ileum. It is often found in cases of serious abdominal disease affecting intestines, but I have not found it pathognomonic of obstruction.

In cases where gut is caught in a tight ligature strangulation is present; and the symptoms from the beginning are acute and grave. The case is one of internal hernia in fact, and the symptoms are identical with those described for that condition. Such cases are the most fatal, for the condition is rarely diagnosed till the patient is past recovery.

Treatment.—There is but one treatment for the intestinal obstruction after cœliotomy; and that is, to re-open the abdomen and release the gut.

The opening is best made along the line of the healing incision. The sutures are removed; and the lips of the wound separated by a blunt dissector or the handle of a scalpel. The finger is pushed through the peritoneal flaps into the abdomen.

If the trouble is at the seat of the parietal incision the condition will at once show itself, and the re-opening will probably remedy it. The detached coils of gut should be closely inspected, to make certain that no small piece has been strangulated and become gangrenous.

If suspicion is removed from the bowels in the region of the incision, two fingers are inserted into the cavity and the source investigated. Suspicion is of course centred on the raw surface of any pedicle left inside, and the fingers are carried thither. A loop of gut fixed elsewhere than at the mesentery is an almost certain proof of adhesion and kinking; this loop is followed up to its fixed point and the next proceeding is to separate it therefrom.

Now, the separation of bowel from a raw surface to which it has been adherent for a week, more or less, is not an easy matter. It is very different from the separation of simple peritonitic adhesions. These last can easily be peeled or stripped; the former cannot so be treated except at great risk of lacerating the bowel.

The seat of adhesion should if possible be brought to the surface; it should certainly be brought within sight. The intestinal wall will be incorporated with the pedicle tissue, and its separation by tearing will seriously damage the already inflamed bowel. If possible, a new ligature should be placed below the old; and the pedicle bodily cut through a little above the old ligature, and delivered with the bowel. Then we can deal with it deliberately. In most cases it will be best to leave it attached to the bowel after trimming the areolar tissue down and suturing the peritoneum over it. If a new pedicle-ligature cannot be placed and it is necessary to separate the gut inside the abdomen, the use of scissors will be advisable. In the separation, division is made away from the bowel and into the tissues of the pedicle. After separation, the gut, grasped accurately around the seat of attachment, in case of perforation, is delivered and examined. A continuous Dupuytren's suture closes in any lacerated or doubtful area, the gut is cleansed, and either returned at once or emptied or drained according to the instructions laid down under "Intestinal Obstruction."

The occurrence of obstruction from adhesion of bowel to a surface denuded of peritoneum reminds us that, wherever possible, we should cover up such surface by peritoneum. The danger is greatest where the raw surface is farthest from the mesenteric

attachment, because then kinking is most likely to take place. Adhesions to the liver would not be so dangerous as adhesions to the uterus or the bladder. In ovariectomy it is quite easy to leave a little flap of peritoneum to cover the raw stump, and fix it over it like a cap by a fine suture.

SECTION III.

OPERATIONS ON THE OVARIES, THE FALLOPIAN TUBES, AND THE BROAD LIGAMENTS.

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OPERATIONS ON THE OVARIES, THE FALLOPIAN TUBES, AND THE BROAD LIGAMENTS.

By far the most important and extensive part of abdominal surgery is concerned with tumours of the ovary. It was here that the surgery of the abdomen signalised its first triumphs; and it has been chiefly through the practical experience gained in this field that the present proud position of peritoneal surgery has been established.

In this section we have to deal with the ovaries, the broad ligaments and parovarium, and the Fallopian tubes. For the sake of practical convenience, inflammatory diseases of the ovaries are considered along with diseases of the Fallopian tubes; the whole being collectively treated under Operations on the Uterine Appendages. Operations for growths in the broad ligament and parovarium, though they are usually described as ovariectomies, are here separately considered.

Ovariectomy.

SURGICAL ANATOMY OF THE OVARY.

The ovaries lie in the posterior folds of the broad ligaments, at the level of the brim of the pelvis. In front, they are in contact with the broad ligaments; behind, they are separated from the rectum by the coils of ileum which usually occupy Douglas's pouch. Their position is not fixed and stable: displacements are caused, normally, by the filling and emptying of the bladder and the rectum; and, pathologically, by enlargements and malpositions of the uterus.

The ovary is attached to the broad ligament along one border, and to the uterus by a rounded fold of peritoneum containing muscular fibre (the utero-ovarian ligament), which is inserted into its internal extremity; at its external extremity is attached that part of the upper border of the broad ligament known as tubo-ovarian or infundibulo-pelvic. The ovary therefore occupies the apex of a ligamentous triangle, the base of which is in the broad ligament, and the angles of which lie at the uterus and the pelvic brim.

At the junction of the ovary with its fold of broad ligament is the hilum of the ovary. Here is situated the mass of spongy vascular erectile tissue known as the bulb of the ovary, and to this point converge the numerous small vessels, branches of the ovarian artery, which supply the gland. The ovarian artery, a branch of the aorta, leaving the inner aspect of the iliac vessels at the pelvic brim, runs a tortuous course along the upper border of the broad ligament, between its folds, to its bifurcation near the uterus. On the outer side of the ovary, it gives off branches to the ampulla; and on the inner side, to the isthmus of the Fallopian tube and to the round ligament; midway, it gives off the branches which supply the ovary. As many as ten or twenty branches may be given off. The veins are even more numerous, and constitute a closely set network, which com-

municates above with the pampiniform plexus, and below with the vaginal plexus, and is finally gathered into the ovarian vein, which discharges itself into the renal vein on the left side, and into the vena cava on the right side.

The fold of broad ligament containing these numerous arterial and venous branches constitutes the surgical pedicle. A ligature placed close to the ovary necessarily constricts all these branches, but may not include the trunk of the ovarian artery. Under ordinary circumstances, however, constriction of these branches by ligature interferes with the circulation of the ovarian artery, and may even check it: if the Fallopian tube is included as well, the chances of complete occlusion of the artery are increased.

The relations of the ovary to the Fallopian tube are of importance. The observations of His, confirmed by Doran, Tait, Hart, and others, seem to show that the generally accepted views as to the mutual position of these organs are erroneous. The ovary hangs obliquely from its ligament, and the Fallopian tube forms a loop round it, running from without inwards and downwards. The fimbriæ of the tube thus lie behind and below the ovary, covering a considerable portion of its surface. It would further appear that the long axes of the ovaries do not lie transversely, but in lines extending forwards and outwards. Considerable variations in position are, however, compatible with normal conditions.

In tumours of the ovary which rise into the abdomen, the ovarian attachments are stretched and drawn out, forming the so-called "pedicle." Such a pedicle contains, not only the true ligaments of the ovary, but also part of the broad ligament, and in the great majority of instances the Fallopian tube as well. The surgical management of this pedicle, now probably settled, has been one of the most fertile sources of dispute in abdominal surgery.

The weight of the healthy ovary, according to Farre, varies from 60 to 135 grains. Its average diameters are: longitudinal, $1\frac{1}{8}$ in.; transverse, $\frac{3}{4}$ in.; perpendicular, $\frac{3}{8}$ in.; but these measurements are liable to considerable variations.

"On microscopic examination the ovary will be found to consist of two distinct parts. That portion forming its free border is the *oöphoron*; it is the egg-bearing segment and is full of follicles in various stages of development, maturation and decay. The ripe follicles are easily recognised by their size, and the recently ruptured follicles usually present themselves as *corpora lutea*, so called in consequence of the peculiar yellow colour of the tissue of which they are composed. The portion in relation with the hilum is the *paroöphoron*; it never contains follicles, and is usually composed of fibrous tissue traversed by numerous blood-vessels. In young ovaries the paroöphoron may present remnants of gland tubules, vestiges of the *mesonephros* (Wolffian body) from which it is mainly derived. The excretory tubules and ducts of that interesting structure are invariably attached to the ovary and known as the *parovarium*."*

As will be seen, this natural anatomical division has importance surgically as well, for each ovarian region has its variety of tumour growth.

It is necessary to emphasise the fact, that in women who have borne children, as well as in many who have not, the normal topography of the ovary may be much disturbed without causing symptoms. I have, on many occasions, noted the position of the ovaries in cases which have appeared on the post-mortem table of the Bristol Infirmary, and I have been much impressed with the variety of position which the ovaries have assumed without causing symptoms which were noted during life. The most common displacement is downwards, chiefly from elongation of the infundibulo-pelvic ligament, permitting the outer extremity to drop lowest, and the whole to gravitate towards Douglas's pouch. On the left side, displacements are perhaps most common. I have found healthy non-adherent ovaries on the brim of the true pelvis at the insertion of the broad ligament, at the sacro-iliac articulation, in front of the broad ligament, behind the internal inguinal ring, and in an almost endless variety of abnormal situations.

This sensibility of the ovarian ligaments has advantages

* Bland Sutton, *Surg. Dis. of Ovaries, &c.*, Lond., 1891.

from the surgical point of view. It permits of the glands being brought to the surface in abdominal operations; or into the vagina, where removal by this method is contemplated.

TUMOURS OF THE OVARY.

It is almost impossible to classify tumours of the ovary so as to satisfy pathological and clinical requirements. The natural clinical division into Cystic and Solid upsets the pathological divisions according to the origin and nature of the growths; and attempts to merge the two may result in a double confusion. The classification of Bland Sutton seems to me to be the most natural and the most useful; it is as follows:

A.—*Cystic Growths.*

I. Oöphoronic Cysts.

- (a) Simple Cysts—unilocular and multilocular.
- (b) Adenomata—usually multilocular.
- (c) Dermoids—unilocular and multilocular.

II. Paroöphoronic Cysts.

Warty Ovaries.

III. Parovarian Cysts.

IV. Ovarian Hydrocele.

B.—*Solid Growths.*

Fibroma; Myoma; Sarcoma, Carcinoma.

This classification as regards the great majority of tumours, the cystic, follows the natural division of the ovary into its histological and anatomical elements. The oöphoron or ovary proper provides the growths familiarly known as ovarian cystoma simple or adenoid, and the variety known as ovarian dermoid. The parovarium provides a special class of cystic growth; and the paroöphoron another class: both are, however, clinically related. Ovarian Hydrocele is not a tumour in the strictest sense of the word; clinically it may be so considered. The exact origin of solid growths is of less importance than the fact of their solidity; and no strong objection need be taken to their being placed as a class by themselves.

In the practical description separate accounts are given of ordinary simple and glandular growths (cystomata); of dermoids; of solid tumours; and of simple and papillomatous growths opening up the broad ligaments.

SIMPLE MULTILOCULAR AND GLANDULAR CYSTS OF THE OVARY.
OVARIAN CYSTOMA.

The investigations of our most competent pathologists would seem to favour the view that true cystic disease has its origin in connection with the natural retrograde metamorphosis of the Graafian follicle.* The steps which lie between the first changes in the ovary and the fully-developed cystoma have not been clearly traced. The pathological appearances vary much in detail, but they are sufficiently definite in general to make the recognition of an ordinary cystoma a matter of no difficulty.

An ovarian cystoma usually consists of one large cyst and a varying number of small ones. As a rule, the large cyst lies farthest away from the peduncular attachment of the tumour, the smaller cysts being placed near to this site of attachment; but there are many exceptions to this rule. The walls of the cyst are composed of pure fibrous tissues of varying thickness. They are covered, on the outside, with flattened cubical cells, closely resembling ordinary endothelium; on the inside, with endothelium and varieties of glandular cells. The fluid in ovarian cysts is typically of a glairy or colloid nature; white, or grey, or greyish-yellow, in colour; very albuminous, and of high specific gravity.

When exposed to view, an uninfamed multilocular cyst presents a white glistening or pearly surface, perfectly smooth to the touch. If secondary cysts be in the cyst-wall, they may protrude outwards, forming smooth rounded bosses of varying size on the main cyst; or they may bulge inwards, showing areas of different colour and consistency on the surface of the

* This and other questions in ovarian pathology are philosophically handled by Alban Doran, in his work on *Tumours of the Ovary, Fallopian Tube, and Broad Ligament*. London, 1884; and by Bland Sutton in *Surg. Dis. o Ovaries, &c.* London, 1891.

cyst-wall. The fluid found in the chief cyst is usually of the glairy nature already described; but sometimes it is watery and colourless, when we are told to expect papillomatous growths inside; and not unfrequently it is dark red, brown, or chocolate coloured, from admixture with blood. When masses of glandular semi-solid material are developed in the centre of the cyst, the fluid is said to become thick and colloid, almost coherent. In the secondary cysts the nature of the fluid is still more variable. Some of these have pale watery contents; others, almost pure blood; others, very thick stringy or colloid material; and some may contain fluid indistinguishable from pus. In closely-set small cysts the contents are most frequently colloid or jelly-like, capable of being lifted out by the fingers, and too thick to be drawn off by cannula.

Much has been written on the possibility of diagnosing ovarian fluid through its chemical composition and microscopic constituents: even the spectroscope has been called in to aid us. Chemistry has certainly failed, and so has the spectroscope; and the presence of certain peculiar cells, which were for some time considered as pathognomonic, has now been proved almost valueless for diagnostic purposes. The vacuolated cells of Thornton and Foulis are now known not to be characteristic of malignant disease, as was at one time thought certain; and we are now practically left without any single reliable physical test of the contents of an ovarian cyst. We can say that a fluid is ovarian with a greater probability of truth than we can say that it is not; and in most cases the grounds of this statement might rest as securely on the simple visual appearance of the fluid, as on its composition or the nature of the cells contained in it. But the value of all such tests is best estimated by the weight which practical men put upon it—and that is almost nil. We never hear of the removal of ovarian fluid for examination; the diagnosis is made by other means.

Certain developmental changes are found in cystomata. Thus, from crowding of secondary cysts, their contiguous walls may disappear, and the cavities may communicate. Or the

wall of the main cyst may be ruptured, and the secondary cysts, protruding through the opening, may form the chief bulk of the tumour. In such cases the operation for removal is usually difficult, on account of the tenuity of the cyst-walls, the density of their contents, and their tendency to become adherent to abdominal organs. A curious variety is the so-called tubo-ovarian cyst, where there is a free communication between the cyst-cavity and the distended Fallopian tube adherent by its fimbriated extremity.* From the fact that the cyst in the ovary is usually monolocular and thin-walled, and rarely is found large, it is probable that the original growth in these cases is not a true glandular cystoma, but a simple cyst such as is found in chronic inflammation. A rare and somewhat puzzling condition arises when there are two ovarian cysts, and their walls become fused, while their cavities communicate. In this case there are two pedicles to deal with. Solid matter inside a cystoma, Doran† found present in 26 out of 366 cases, and in 14 of these the structure was adeno-sarcoma. In nearly a third of his cases glandular material was present in varying amount. Thin-walled pedunculated and sessile cysts are sometimes found attached to the main wall. Other peculiar developments—as, small localised masses of connective tissue, or wart-like bodies, or even true papilloma—may be found growing on the inner surface of the cyst. Certain changes or accidents liable to take place in the developed growth will be referred to further on.

All such growths have a pedicle: a so-called sessile ovarian cystoma is simply one with a very short pedicle. This pedicle is a very variable structure. In length, it varies from six inches or even more, down to a vanishing point; in breadth, it varies between that of the whole length of the broad ligament and some fraction of an inch; and in thickness, its dimensions lie between the tenuity of membrane and the bulk of the palm of the hand, or even more. The vessels that supply the growth, also most variable in size and number, lie in the pedicle. Anatomically, a true pedicle is composed of the ovarian

* See Griffith, *Obstet. Trans.*, xxix., 1888. † *Op. cit.*, p. 21.

ligaments, some portion of the broad ligament, and the Fallopian tube—all of them hypertrophied.

Diagnosis.—There is something characteristic in the appearance of an abdomen enlarged by an ovarian tumour. There is a bulging forwards, not so marked as in pregnancy, where the tumour appears to start straight out of the pelvis; and more marked than in ascites, where the enlargement involves the whole abdomen and causes bulging in the flanks. The position of an ovarian tumour of moderate size is best suggested by supposing that it rests chiefly upon the promontory of the sacrum. It occupies the lower portions of the abdominal cavity, and causes stretching of the parietes chiefly in these portions. This is apparent by the increase of distance between the umbilicus and pubes, greater than between the sternum and umbilicus, and by the appearance of lineæ albicantes (where they exist at all) at each side of and below the umbilicus.

Palpation reveals a rounded, cystic and probably fluctuating growth, movable in most cases, and remotely connected with the uterus. Small tumours appear to be perfectly globular, and are smooth on the surface; large growths are usually somewhat irregular in shape, from the development of secondary cysts in their walls. In thin-walled cysts which are not greatly subdivided by septa, or in which one cyst considerably exceeds the others in size, a fluctuation thrill may be distinctly felt. If the cyst-wall is thick, or if the growth is very multilocular, or its contents colloid, fluctuation may be absent.

A sensation of crepitus may be produced by the friction of inflamed surfaces; such crepitus, of course, contra-indicates adhesions to the spot where it is felt. The diagnosis of adhesions is very uncertain; free mobility of parietes over tumour indicates that there are not closely set, dense, or short adhesions; long bands may permit considerable mobility. A condition of fixity between cyst-wall and parietes is very difficult to be assured of. Doran mentions a case in which he and several of his colleagues thought that a cyst was fixed to the abdominal walls; but not a single parietal adhesion

was found when the operation was performed. I have met with several analogous instances; and I am convinced that the diagnosis of parietal adhesions is most difficult and uncertain.

Vaginal palpation reveals a uterus normal in size, displaced either backwards or forwards, or to one side, and most frequently depressed. The uterus is somewhat frequently enlarged—always so, if the growth is closely adherent to it. If the tumour is small and has not escaped from the pelvis, the uterus will be displaced forwards; when the growth is of considerable bulk and placed in the abdomen, the uterus lies indifferently in front of or behind the growth. When it lies in front, it is sometimes quite easy to palpate its outlines through the abdominal wall above the pubes. Rotation of the growth on its transverse axis, by no means a rare occurrence, causes the uterus to be dragged upwards. If the growth is movable and the pedicle not very long, movements communicated to it are felt in the uterus. If the growth is large or fixed, and the pedicle short, or the uterus adherent to it, passage of the sound will show that the fundus of the uterus cannot be moved away from the tumour. This sign introduces an element of confusion between ovarian and uterine growths.

By percussion we diagnose the presence of a non-resonant body in the lower, or lower and middle, abdomen. From the point where the growth comes into contact with the parietes above, down to the pubes, dulness is absolute. Over the anterior aspect of the tumour there is also absolute dulness; at the sides this dulness is not so absolute, and in the flanks there is positive resonance. Tait well describes the ovarian tumour as being surrounded with a "tympanic corona," a ring of resonance marking the lateral and upper limits of growth, where the bowel crowds round it and comes into contact with the parietes. If the tumour is large, there may be dulness in one or even both flanks; sometimes, in very large growths, resonance is absent over the whole abdominal area. Ascites associated with the tumour may cause lumbar dulness, as may loaded bowels.

Auscultation reveals little of positive value in the diagnosis of ovarian cysts. Negatively it may be useful, as showing the absence of sounds characteristic of other conditions. Exploratory puncture has practically been abolished as a means of diagnosing ovarian cysts.

As regards general and subjective symptoms, experience shows that they are almost valueless. Some tumours grow quickly, some slowly; some are very painful; others attain to enormous dimensions, producing nothing more than discomfort from their bulk. Menorrhagia, amenorrhœa, or normal uterine functions, are found present with equal impartiality. Disturbances of micturition or of defæcation may exist, or they may not. Sickness is not a very common symptom, but there are cases where sickness and vomiting are very troublesome. Œdema of legs, parietes, or vulva, may be found in small growths, and they may be absent in very large ones. Disturbances of the renal functions are present or absent. And so it is through the whole group of rational and associated symptoms: there is not one whose absence disproves ovarian disease, and not one whose presence proves it; indeed, there is perhaps no association of such symptoms which would be of the slightest value for accurate diagnosis. This must rest on the physical bases alone.

The diagnosis of ovarian from other abdominal tumours is a very large subject indeed. It is literally the fact that there is scarcely a single form of abdominal growth, of dimensions as large as a child's head, that has not been mistaken for ovarian tumour. No doubt some of these mistakes are to be accounted for by carelessness or ignorance; but many of them have occurred in the hands of our most distinguished operators. But such mistakes are daily becoming less common; advancing knowledge of all tumours is narrowing down the diagnosis of each. The earlier writers put before us a list of growths which might be mistaken for ovarian that was almost co-extensive with abdominal tumours; at present, we should be perhaps right in limiting our differentiation to half-a-dozen. Ovarian

cystic disease is, I think, most liable to be confounded with the following :

Encysted Peritoneal Dropsy.

Renal Cystic Tumours.

Cysts of the Broad Ligament.

Fibro-cystic Disease of the Uterus.

Ascites.

In many cases *encysted dropsy of the peritoneum* cannot be diagnosed from ovarian cyst. The points specially to be looked into are : whether or not there is resonance between the pubes and the tumour—a condition sometimes found in encysted dropsy, but almost never in ovarian cyst ; whether, on deep pressure at the periphery of the cyst, the bowels appear to be sessile on its walls—or rather, whether the growth appears to spring from the midst of the coils of intestine. It is rarely the case that an ovarian cyst small enough to be examined in this way is palpably connected closely with bowel. The walls of an encysted peritoneal collection of fluid are thin ; and there is no evidence of secondary cysts, and herein it resembles parovarian cyst. But the latter is very rarely adherent to bowel, and still more rarely appears to be imbedded in intestinal coils. The fluid is under low pressure, and fluctuates freely, in encysted dropsy.

In the case of *cystic renal tumours*, mistakes are not likely to arise unless the growth is of a large size, filling the whole of the cavity, and unless there is absence of special urinary symptoms. The most important differentiating sign is, in the case of renal growths, deep and firm fixation in one or other loin. It is not often that an ovarian cyst, even of very large growth, so completely occupies a lumbar hollow as a renal growth. An ovarian growth may completely fill the costo-iliac space, and may cause the flanks to bulge ; but it does not appear to spring from this region, having most of its bulk in and around it. Not much value can be attached to the absence of signs derived from vaginal palpation. A sign of

importance is the palpation of large bowel on the surface of a renal tumour.

Cysts of the broad ligament may be simple monolocular growths containing fluid, which are best known as parovarian cysts; or polycystic growths, arising in the hilum of the ovary, or elsewhere in the broad ligament, which most frequently contain papillomatous material. A simple parovarian cyst is thin-walled, fluctuates freely, and is globular and smooth on the surface. A papillomatous cyst of the broad ligament is multilocular, deeply sessile in the pelvis, and is often intimately connected with the uterus, which is usually dragged upwards. If the papillomatous material is abundant, there is boggy rather than fluctuation.

Fibro-cystic disease of the uterus is more rare than is commonly supposed. It is probable that most of the cases described as fibro-cyst of the uterus would, in the light of our more perfect recent pathological knowledge, have been recognised as ovarian or broad ligament growths which had become intimately adherent to the uterus. Beyond an intimate connection with the uterus, which may exist in other growths, there is little to guide us in diagnosing fibro-cyst. The striking cases described by Spencer Wells presented symptoms which were not very characteristic.

Ascites is perhaps least liable of the conditions mentioned to be mistaken for ovarian cystoma. Error can scarcely arise unless the abdominal distension is very considerable. In distinguishing minor degrees of enlargement, the most important guides are the sites of the areas of resonance and dulness. An ovarian cystoma grows upwards from the pubes, and gives a circular area of dulness in the middle, surrounded by a ring of resonance which extends backwards into the flanks. (Figs. 5 and 6.) Ascites increases from the flanks forwards (speaking of the supine posture), and when the fluid comes into contact with the anterior parietes, gives a crescentic area of dulness, the concavity of which looks upwards, with resonance only between the sternum and this crescentic hollow. (Figs. 4 and 7.) In ascites, when the enlargement is very great,

there may be dulness up to the sternum ; and when ascites is present with ovarian tumour, there may be dulness in both flanks. Under these conditions diagnosis may be somewhat difficult. Variations of posture increase the resonant areas in ascites more than in cystoma, and the fluctuation thrill is more distinct in ascites. Also, in ascites, there is more bulging or bagging of the distensible portions of the abdominal sac at the loins, in Douglas's pouch, and at the umbilicus ; and the whole belly is flatter than in cystoma.

DERMOID CYSTS OF THE OVARY.

About one of ten ovarian tumours is either entirely or partially dermoid. Their exact origin is still matter of uncertainty, and need not here be discussed. It is generally agreed that the rudiments of all dermoid cysts exist at birth, and that they may remain quiescent indefinitely, or start into active growth at any period from, or even before, birth to old age. Dermoid ovarian growths most frequently manifest themselves soon after puberty.

Dermoid cysts are rarely of large size ; it is not often that they are larger than a child's head. The bulk of their contents is composed of a thick greasy material, such as is found in sebaceous tumours of the scalp. The cyst-wall inside the fibrous envelope is composed of structures similar to those found in the skin. From within outwards, we meet, first, with a layer of epidermis, from which sprouts a growth of hair, and in which we may often detect rudiments of all the elements found in healthy skin : outside of this lies a layer of connective tissue, corresponding to the cutis ; and outermost of all, under the fibrous capsule, is a layer of fatty tissue, corresponding to the panniculus adiposus.

A dermoid ovarian cyst is usually divided by septa into separate portions ; and the contents may differ in the various loculi. The main cyst often contains a greasy chocolate-coloured fluid, while the others are full of the characteristic sebaceous material. Hairs may be shed into the cavities in large quantities, and sometimes form masses which appear as if they had been rolled into balls. But the most striking contents are pieces of true bone, most frequently stunted alveolar processes, with teeth either free

or embedded in the alveoli. As many as three hundred teeth have been found in one dermoid cyst.

There usually exists a very perceptible enlargement of the sebaceous follicles in the cyst-wall. Frequently they attain to the dimensions of secondary cysts, and a similar development may take place in the sweat glands. Hyaline cartilage is often found in the cyst-wall; and nerve tissue, unstriped muscular fibre, and other elements may be detected. Malignant tumours have been found growing in dermoid cysts. Recently in the Bristol Infirmary I removed from a woman aged 59 a suppurating dermoid cyst, in the wall of which was a solid sarcomatous growth as large as an hen's egg. As yet there has been no secondary development. More than one observer has noted that malignant tumours of the abdominal cavity sometimes follow removal of dermoid cysts; no doubt the primary elements existed in the dermoid growths.

Both ovaries are liable to be diseased in a proportion of cases larger than in cystoma. Also, ordinary glandular cystic disease is found to co-exist with dermoid cysts in a proportion of instances larger than would be likely if it were mere coincidence. Any causal connection between the two is not likely to be more than a stimulus to development started by increased vascular supply from the one which first began to take on diseased action.

The outer aspect of a dermoid cyst is different from that of an ordinary cystoma. The glistening pearly aspect of the latter is replaced by a muddy or opaque appearance darker in colour, sometimes even approaching to brown. Adhesions are common in dermoid cysts, chiefly because they are liable to become inflamed.

Diagnosis.—A dermoid cyst may be suspected; but it can rarely be accurately diagnosed. The history and physical signs of dermoid growth may be identical with those of cystoma containing colloid material. In the very rare event of bone being discovered by bimanual palpation, diagnosis is certain; and this is perhaps the only sign, short of operation or exploratory puncture or discharge of contents by suppuration, which can be looked upon as definitely diagnostic. A thick cyst-wall, boggy and not

fluctuation, and a size less than that of a man's head, nearly always found in dermoid cysts, are not infrequently found in other cystic growths of the ovaries.

ACCIDENTAL CHANGES IN CYSTIC GROWTHS OF THE OVARIES.

Cystic ovarian growths are liable to certain accidents which are not necessarily connected with their pathological development. The most important of these are :

Rupture of the Cyst-wall.

Twisting of the Pedicle, and

Inflammation or Suppuration in the growth.

Rupture.—Any breach in the continuity of the cyst-wall may be defined as a rupture. It may exist either as a slow leakage through a minute opening or openings, or as a rapid evacuation of contents through a large rent. The general effects of rupture will depend on the size of the cyst, the nature of its contents, and the rapidity with which they are discharged into the peritoneal cavity. Simple oozing or leakage may, if the contents are benign, produce no symptoms beyond diminution in the size of the cyst. A large rent may result in collapse or rapid death, or slow recovery, or may terminate in peritonitis. If the contents are suppurating, death usually results from peritonitis, unless operation is performed; if they are benign and watery, recovery may take place without much difficulty.

The causes of rupture are varied. A frequent cause is overgrowth of intra-cystic solid matter, usually papillomatous; and in this case the rupture is of the nature of a slow leakage through thinned and necrosed portions of the cyst-wall, and does not produce very acute symptoms. Spontaneous rents may take place in thin parts of over-distended cysts. A tense, but otherwise healthy, cyst-wall may be ruptured by a blow, or even by rough handling; and in such a case the immediate symptoms may be very acute and very alarming. The rupture of an acutely inflamed or suppurating cyst is of the nature of the bursting of an abscess

inside the peritoneal cavity, and is immediately followed by grave and alarming symptoms. In one case of gangrenous cyst, I found high up under the liver a mass of glandular growth as large as the fist which had escaped from a rent in the cyst-wall.

Hæmorrhage after rupture of a cyst is not usually severe. If bleeding is free, it is more likely to rise in the form of a passive oozing from the abundant vessels of intra-cystic papillomatous growths, than from the torn vessels in the rent.

Cysts containing papillomatus growths are peculiarly liable to undergo rupture—not once only, but several times. The immediate danger is not great, because the free flow of fluid is prevented by the villi plugging the opening; but the remote danger is considerable from infection of the peritoneum. In multilocular cystomata, the thin-walled secondary cysts are most liable to rupture. Dermoid cysts usually rupture into some neighbouring cavity—bladder or rectum most frequently—rather than into the peritoneum.

Twisting of the Pedicle.—Rotation of ovarian tumours, resulting, as it sometimes does, in twisting of the pedicle and strangulation of its vessels, may be an accident of serious moment. Terillon estimates that it occurs in about 6 per cent. of all cases. Much speculation has been offered as to its cause. Tait very ingeniously seeks to explain it as caused by repeated small displacements of the growth round its axis, through the passage of the fæces along the sigmoid flexure and rectum. Pregnancy is so frequently associated with the condition that it may be described as a cause. Dermoid growths are specially liable to undergo rotation. Slight twisting may produce no effects; but the result, if the twisting is two, three, or more times,* may be atrophy, rupture, or gangrene of the tumour. Complete detachment is rare. Sometimes the tumour continues to live while remaining free in the cavity; more frequently it contracts adhesions with neighbouring organs, and especially with the omentum.

In many cases a twisting of the pedicle is attended with no symptoms. In such the pedicle will probably be long, thin, and

* See Hunter in *N. Y. Med. Rec.*, 1885, xxvii., p. 359.

lax. Usually, however, with pedicles of ordinary conformation, signs of congestion or inflammation are present, such as opacity and want of lustre in the cyst-wall, with extravasation of blood into the cyst-cavity. The hæmorrhage into a cyst whose pedicle has been twisted may be so considerable as to produce symptoms of loss of blood. Inflammation may proceed to suppuration in these cases; and not a few of the described cases of gangrene have been attributed to twisting of the pedicle.

Doran,* Chalot,† myself,‡ and others have recorded some remarkable cases where the vitality of the tumour has been maintained by adventitious adhesions after the pedicle has been twisted through. It is probable that many dermoid cysts of the abdomen that have been described as non-ovarian are really ovarian cysts that have been separated from their pedicles.

Suppuration in Cysts.—Suppuration in the growth, attended, as it always is, with acute peritonitis, is a most serious complication. The immediate causes of suppuration are various: inflammation, from traumatism; localised gangrene; strangulation of the pedicle, from twisting; introduction of septic matters into the cystic cavity, from tapping. Inflammation in the cyst-wall is communicated to the peritoneum, and may set up general peritonitis of the most dangerous character. Localised inflammation of a non-septic nature may exist in a minor secondary cyst without producing alarming symptoms: as a rule, however, suppuration signifies its presence in an unmistakable and emphatic manner.

When any of these accidents occur—suppuration, twisting of pedicle, or rupture—immediate operation is indicated. The danger from suppuration is greatest; twisting of the pedicle is dangerous chiefly when followed by congestion, which runs on to gangrene or suppuration, and is only inferred from the existence of such inflammatory disturbance; rupture is least dangerous as

* *Med. Chir. Trans.*, vol. lxviii., 1885, p. 235.

† *Ann. de Gyn. et d'Obst.* Mar., July, 1887.

‡ *Brit. Gynec. Journ.*, vol. iii., 1888, p. 362—where there is a full description of the growth with drawings by Mr. Bland Sutton.

a rule, but is sometimes rapidly fatal. In all, danger to life, immediate as well as remote, is lessened by operation. Keith first taught us how to deal with suppurating cysts: his successful teaching has been extended to the treatment of the other accidents to which pedunculated cystic growths are liable.

Some reference must be made to that peculiar variety of ovarian cystoma called by Tait "Rokitansky's tumour." It was first described by Rokitansky as a special variety of cystoma; and Ritchie first described the presence of ova in its cysts. "These tumours are always double, no case having yet been described as having occurred on one side only. They are always of very slow growth; their cysts are uniformly small, rarely reaching the size of an orange, and generally being little bigger than grapes. The tumours are never large, and it is only the fact that both ovaries are always affected that makes them objects for surgical interference. The contents of the cysts are invariably limpid, and the ovum may nearly always be found; and in these two respects, as well as in the immense number of the cysts, the tumours differ absolutely from ordinary cystoma."* Tait has operated upon two such cases, and a preparation from one of his cases is placed in the Hunterian Museum. Bland Sutton says he has not been able to find this specimen. I have operated on one case where the double tumours would agree with the description given above; the specimens are now in the Pathological Museum of Bristol University College.

TAPPING OVARIAN CYSTOMATA.

The present position of tapping as a surgical procedure in ovarian cystoma is rather as a measure for temporarily relieving symptoms, than as a plan of treatment. As an aid to diagnosis, it has been practically discarded. As a method of cure it has long been accounted futile. And even as a means of ameliorating symptoms, it is doubtful if the combined risks, immediate

* Tait, *Diseases of the Ovaries*, 4th Ed., 1883, p. 169.

and remote, are not always as great as those following complete removal of the tumour.

The occasions on which tapping may be legitimately adopted are two-fold: firstly, when removal of the growth is inadmissible; and secondly, when the patient is suffering from some incidental ailment which renders postponement of operation necessary. In the first case, tapping is used simply to promote euthanasia; in the second, to gain time for improvement of the patient's condition. The coincidence of any grave and incurable disease, such as cancer, phthisis, or advanced disease of the heart, or in fact any condition which negatives surgical operation of any sort, negatives ovariectomy. Here tapping may be advisable, to prolong life or to render it less painful. On the other hand, if a patient is suffering from an acute disease—such as bronchitis, or pneumonia, or typhoid fever—which negatives ovariectomy, and the progress of which is likely to be favourably influenced by relieving a distended abdomen, tapping is expedient. Also in chronic complaints, such as bronchitis with dyspnoea, tapping may contribute to the patient's improvement, and so increase the chances of success for the major operation. When the renal functions are upset, or when there is œdema of the limbs from pressure, or generally where the condition of the patient is deteriorated by the existence of intra-abdominal pressure, tapping may, by temporarily removing this pressure, cause material improvement in the patient's condition.

The operation must be conducted with a supreme regard to antiseptic purity. The skin at the site of puncture must be thoroughly cleansed; and the instrument, inside as well as outside, must be perfectly pure. The antiseptic trocar of Ward Cousins is a very suitable instrument for the purpose; and the blunt ascites tubes of Tait and of Wells (Fig. 43) would leave nothing to be desired, if they did not require previous puncture of the abdominal walls by lancet—a necessity which many would consider a disadvantage. The exact nature of the instrument matters little, provided it be small, simple, and as nearly as possible a closed tube. It ought not to be larger than a No. 6 English catheter. A large trocar is doubly objectionable, as

causing a large opening in the cyst-wall, which may leak; and as permitting too rapid a flow of fluid, which may cause shock to the patient. A long rubber tube is attached to the end of the cannula, and conducts the fluid into a suitably placed receptacle. Bandages to compress the abdomen are quite unnecessary. The patient lies on her side near the edge of the bed, and the trocar is inserted at a suitable place, usually somewhere in the middle line,

between the umbilicus and the pubes. The end of the rubber tube is kept under carbolic lotion, and never removed therefrom, as air is liable to enter. A piece of glass tubing inserted in the middle of the rubber tube will show whether fluid continues to flow. When the cannula is removed the opening is pinched between the fingers, and the tissues moved about, so as to destroy the continuity of the perforation. A small piece of lint, soaked in collodion, is sufficient to close the opening. A binder relieves the uncomfortable sense of emptiness which usually remains after relief of abdominal tension.



FIG. 43.

Wells' Ascites
Tube.
Half size.

Conducted properly, the operation of tapping is attended with very slight risks. It is just possible that the disrepute into which the proceeding has fallen is to be attributed to careless manipulation or unclean instruments. Men who have not before their eyes a complete foreknowledge of its possible effects are liable to have recourse to tapping on every occasion when they have a patient suffering from fluid distension of

the abdomen, and such men are not likely to take full scientific precautions.

HISTORY OF OVARIOTOMY.

The history of ovariectomy reads almost like a romance. From being dreamed of as a remote possibility by advanced thinkers some century and a half ago in the capitals of Europe, and attempted by one or two daring enthusiasts, it first reached its

consummation as a definite schemed operation far away from the centres of civilisation. In Great Britain, as in its birthplace, America, the operation had struggled into existence and was thriving in the provinces, before it had established a footing in the capital. It was true of this, as of so many other improvements in practical surgery, that it owed its birth to the freedom and independence of the provincial mind: the spirit of the pioneer had certainly entered the soul of Ephraim McDowell, almost in the backwoods of Kentucky.

There is no doubt but that some form of mutilation of the female sexual organs has been practised from the most ancient times. In most instances this was probably removal of some parts of the external organs of generation; in some, however, it would appear certain that the ovaries were actually removed. This was essentially female castration, or spaying; and the removal, in righteous anger, of the ovaries of his unchaste daughter by the Hungarian sow-gelder, two centuries ago, is probably the last operation of this sort known to history. Such operations, demonstrating, as they did, the possibility of removing ovaries that were healthy, were probably not without their value in clearing the way for the removal of ovaries that were diseased. The value of such operations, however, will be best estimated in considering the operation of oöphorectomy.

To the active and enquiring minds of many surgeons living in the early parts of the eighteenth century, the possibility of removing cystic ovaries was often presented. Willius of Basle, in 1731, spoke perhaps most clearly in favour of the operation, though he had not the courage to attempt it. Delaporte* actually treated an ovarian cyst by incision through the abdominal wall, but did not remove it. Morand, who follows up Delaporte's paper in the same volume by some remarks of his own, desires to give the latter credit for having been the first definitely to propose the removal of an ovarian cyst, and expresses his own opinion that the operation is feasible, provided there be no adhesions. Hunter, in 1762, with the far-seeing genius which we now fully appreciate, actually suggested the small incision, tapping the

* *Mem. de l'Acad. Roy. de Chir.*, tom. ii.; Paris, 1753.

cyst, removing it, and ligaturing the pedicle. A Russian surgeon named Segdel is said to have, in 1784, begun an operation with the view of removing what he believed to be an ovarian tumour; it turned out, however, to be a distension of the Fallopian tube with pus, which, being unable to remove on account of adhesions, he simply incised and drained.* The surgeon who came nearest to being the first ovariologist was Chambon, who, in 1798, published in Paris a treatise on *The Diseases of Women*, wherein he strongly recommended the removal of diseased ovaries. He gave accounts of the anatomy of cystic tumours of the ovaries, and tried to show how to diagnose adhesions, and how to deal with them. John Bell, no doubt familiar with the work of French surgeons, constantly dwelt in his lectures on the possibility and the advisability of removing such tumours, and his teachings bore fruit; for one of his pupils, Ephraim McDowell, was the first ovariologist.

The claims of McDowell of Kentucky to be considered as the first surgeon who deliberately and scientifically planned and performed the operation of removal of an ovarian tumour are now established beyond dispute. The operation of Houston of Glasgow was almost certainly not a complete ovariectomy,† and those of Lammonier of Rouen, Dzondi of Halle, and Galenzowsky of Wilna, even if they had been ovariectomies, which they were not,

* *New York Med. Journ.*, Feb. 11th, 1889.

† It is right to say that Tait, who had made special inquiries into the subject (*Dis. of Ovaries*, 1883, p. 239), claims for Houston the honour of having been the first ovariologist. Now, an ovariectomy is not complete unless the tumour is removed and the pedicle is secured. In Houston's account of his case there is not a suggestion that he did either. It seems to me scarcely credible that a surgeon who could describe, as minutely as Houston did, the somewhat trivial expedient adopted for removing the glairy fluid should leave unmentioned the far more important proceeding of removing the tumour, and dividing and securing the pedicle. "I then squeezed out all I could [of the contents], and stitched up the wound in three places." If between the squeezing and the stitching the grand measures of removing the tumour and securing its pedicle really did occur, I think he must have at least mentioned them. Houston says the tumour was of the left ovary, but the only proof he adduces in support of this is that it lay on the left side. The after-history of the case is in no way inconsistent with his having incised an ovarian growth.

were performed subsequently to the first operation of McDowell. In December, 1809, McDowell operated on Mrs. Crawford, and seven years later he published his report of this and two other operations. In America, the operation thus initiated was taken up by Dunlap of Ohio, by Nathan Smith of Connecticut, by Alban Smith of Kentucky, by Gallop of Vermont, and by many others. Up to the end of 1863, according to Peaslee,* ovariotomy had been reported as performed in America 117 times, with 68 recoveries and 49 deaths. Since then, American surgeons have taken a prominent and honourable share in perfecting the operation, which is now performed everywhere throughout the Continent.

In Great Britain, the operation did not at first make much progress. Lizars operated in Edinburgh once in 1824, and three times in 1825, but with such small success that Liston boasted that he took good care that Lizars did not set about any such operation in the Infirmary after he became attached to it. The medical papers of those days were also dead against the operation; and few attempts and an equal number of failures were recorded till 1836, when William Jeaffreson, a surgeon of Framlingham, operated successfully by the small incision. In the same year, King of Saxmundham had a successful operation; and in 1839, West of Tonbridge had two successes. A few London surgeons operated in the next year or two, in every case unsuccessfully. The thread of success was then picked up by Charles Clay of Manchester in 1842, who, in the words of Peaslee, "soon became the most successful ovariotomist living," and to whom, "more than to all other operators, the credit belongs of having placed the operation of ovariotomy on a sure foundation." Up to 1850, eight years before Spencer Wells began to operate, he had chronicled twenty-one successes out of thirty-three operations—a result more favourable than Wells could show in the same number of cases, not finished till twelve years later. Between 1852 and 1856, Baker Brown operated nine times with seven deaths. This mortality checked him for four years, when he began a career which, but for its untimely

* *Ovarian Tumours*, London, 1873, p. 247.

and unfortunate termination, would probably have done much for ovariectomy.

The year 1858 brings us to the beginning of the remarkable career of Spencer Wells. Commencing with a promise faithfully to record every case, successful or unsuccessful, upon which he operated, he has pursued this course to the present day, when he has well passed the thousand. Round his personality centred all the changes, improvements, and, we must add, retrogressions, which have followed the fortunes of the operation. His hearty readiness to try the recommendations of others, though it has not always been conducive to reduced mortality, has testified to his honesty of purpose and breadth of view.

The next prominent figure in ovariectomy is that of Thomas Keith of Edinburgh. In 1862 he performed his first ovariectomy, and he very soon proved himself the most skilful of all. Some of his operations, such as those for removal of large fibroids, seem almost to have reached the limits of successful human surgery.

And, among those who have more recently entered the field, the brilliancy of results seems still to be on the increase. Tait of Birmingham has attained to a success which is as remarkable as it is well deserved. He can show the extraordinary record of one hundred and thirty-nine ovariectomies without a death, a result which could scarcely be shown for the most trivial surgical operation. At the Samaritan Free Hospital, in London, the mantle of Wells has worthily fallen on the shoulders of Thornton and of Bantock. On the Continent, the names of Koeberlé, Schroeder, Billroth, Martin, and a host of others, are honourably associated with the operation. And all over the civilised world, in every capital, town, and village, there are surgeons who, with honour to their art and credit to themselves, successfully perform the operation, which half a century ago was condemned by the leaders of surgery as being little removed from murder.

APPRECIATION. INDICATIONS FOR OPERATION.

Ovariectomy is the most successful major operation in surgery. Within the memory of living surgeons its mortality has diminished from what was almost the limit of the justifiable in surgery, to a figure which, as statistics are estimated, is practically zero. Our best English operators—Keith, Thornton, Bantock, and others—in the last few years had brought their death-rate down to the marvellously low figure of about ten per cent., more or less, when Lawson Tait's records beat all, by the extraordinary result of one hundred and thirty-nine cases without a death, and a general mortality over several hundreds of cases of less than five per cent. I have lost three in a total of over two hundred ovariectomies; a series of over a hundred has recently been passed without a death. Keith's recent mortality, in private operations with cautery clamp, is, he tells me, under two per cent. Surely this is the *ne plus ultra*, not only of abdominal surgery, but of all surgery. If it is not a justification for the performance of ovariectomy, wherever an ovarian tumour exists, it is undoubtedly a stern command to all who seek to perform the operation, so as to give their patients the best chance of life, to spare no pains to perfect themselves in every detail of attainable knowledge.

With such prospects of recovery, it would seem that little more than the diagnosis of ovarian cystoma was necessary to justify operation. Excluding the just and proper contra-indications to this or any other serious surgical operation, and which need not here be mentioned, there is scarcely a condition in the tumour itself which absolutely forbids operation. The only question is as to the best time for operating. The futility of all modes of medical or incomplete surgical treatment has long been admitted; complete removal alone gives certain recovery. When twenty or thirty, or even forty per cent. of the cases operated upon died, there was some justification for the postponement of the operation till such time as the patient's health and comfort were being interfered with. But with such mortality as the operation now gives in the best hands, this position is scarcely

tenable: in fact, it has been quietly given up. The rule is now to operate early—as soon, in fact, as the existence of the tumour has been proved. The arguments in favour of early operation need not here be dilated upon.* Suffice it to say that, as there is but one escape from the disease, by removal; and as delay involves the risks of changes and accidents in the tumour, of secondary disease in other organs, and of general impairment of health, it is right that the operation should be performed as early as possible.

OVIARTOMY DURING PREGNANCY.

Our appreciation of the position of ovariectomy during pregnancy is rendered more accurate by the publication of an elaborate analysis of 204 operations by Gordon.† Of these 204 operations, 176 were reported with sufficient fulness to permit of analysis. There were twelve deaths amongst the 176 patients—a mortality of 6.8 per cent. There went to labour at full time 122 cases (69 per cent.). There were forty-nine abortions (22 per cent.). There were twelve double ovariectomies: of these five aborted and seven terminated normally. There were ten cases of cyst of the broad ligament: one of these died and six aborted.

It will be seen from these statistics that the mortality is wonderfully low; in fact, it is doubtful if it is at all increased by operation during pregnancy. It seems proved, however, that the operation tends to cause abortion—about one in five having this result. The chances of abortion are increased in removal of cysts of the broad ligaments and in removal of both ovaries. It may therefore be affirmed that the only objection to ovariectomy during pregnancy is this risk of abortion.

Now, there would seem to be no doubt (although there are no statistics to prove it) that the mere existence of an ovarian cystoma predisposes to abortion and to other dangers of the pregnant state; while it is certain that pregnancy renders more likely the ordinary accidents to which cystoma is liable. The

* See Bantock's *Plea for Early Ovariectomy*. London, 1881.

† *Vratch*, No. 1., 1894. Abstract in *Brit. Med. Journ.*, vol. i., p. 42, 1894.

decision as to operation, therefore, is an estimate between the risk of abortion from operation, on the one hand; and, on the other, the risks of abortion and of rupture or suppuration or gangrene in the tumour, and perhaps of difficulty or danger during labour. As regards the preservation of the woman's life, removal of the tumour would probably be indicated; as regards the saving of the child, non-interference would certainly be indicated.

A good deal of weight would be paid to the nature of the case. The points specially to be attended to in the case are: The rapidity of the growth of the tumour, the period of gestation, and the general condition of the patient. A tumour of rapid growth discovered in the early days of pregnancy might be removed, when another of slow growth, large, and possibly difficult of removal, might be tapped, particularly if the time of delivery were at hand. A strong vigorous woman, with a capacious abdomen, might be left untouched, when a weakly woman of small size might be better operated upon. Then, the patient's wishes should have some weight. The desire to have a living child, even at the expense of some additional risk, may legitimately be acquiesced in by the surgeon.

The Operation of Ovariectomy.

Preliminary.

Assistance.

Instruments.

Parietal Incision.

Emptying and Delivery of Cyst.

Separation of Adhesions.

Treatment of Pedicle.

Peritoneal Toilet.

Drainage.

Closure of Wound.

Preliminary.—The patient will have been prepared according to the general directions already given. Her bowels will have been opened by an aperient, and she will have passed water

immediately before the hour fixed for operation. She is placed on the operating table, dressed in a flannel jacket, and her limbs are covered by warm blankets or surrounded in cotton wool; and, if deemed expedient, a layer of cotton wool is laid over the chest and abdomen, up to the limits of the opening in the macintosh sheet. A special combined operating suit is the most convenient covering for the patient. The sheet is placed in position so that the hole leaves exposed the site of operation, and elsewhere completely covers the patient, and hangs over the edges of the operating table. The adhesive material spread round the margin of the opening keeps the sheeting closely in contact with the skin on the parietes. The exposed skin and the macintosh around are once more cleansed with carbolic lotion, and sponge-cloths wrung out of 1-40 carbolic lotion are laid over the macintosh around the opening. The patient's thighs are confined by broad webbing fixed to or tied under the table. A receiver, to collect the fluid, is placed at the side of the table next to the operator. If the operating table described (Fig. 10) above is used, the special receiver and shoot will be attached.

Assistance.—Besides the anæsthetist, one assistant is all that is necessary. His special duties will be, to sponge, to manipulate forceps during the application of ligatures, and to help during the deligation of the pedicle and the suturing of the abdominal wound; besides these, he will be frequently called upon to discharge other minor functions, too numerous to be mentioned. A nurse will be wanted, to cleanse and hand sponges, and to see to the provision of hot water, lotions, and such minor necessities. The operator helps himself to instruments, which are arranged in trays upon a table placed conveniently within the reach of his right hand. The assistant stands on the left side of the patient, facing the operator. (See Fig. 27.)

Instruments.—The following instruments are recommended for the performance of ovariectomy:

Small hæmostatic pressure forceps (Fig. 22)	12
Thornton's T-shaped pressure forceps (Fig. 20) ...	2
Large cyst forceps—angular and straight (Fig. 23)	4
Medium cyst forceps (Fig. 21)	4
Knife	1
Scissors	2
Pedicle forceps (Fig. 58)	1
Cyst trocar, with tubing, Tait's large (Fig. 49) ...	1
„ „ Spencer Wells's, with Fitch's dome (Fig. 48)	1
Suture needle	1
Reel-stand with silk ligatures	1
Silk-worm gut sutures.	

With these instruments most ovariectomies may be satisfactorily performed. In routine operating, they are laid out in three trays containing enough carbolic lotion to cover them. One tray contains the small hæmostatic forceps, twelve in number; another, of larger size, contains the large and medium sized cyst forceps, ten in number; while the third contains the knife, scissors, pedicle needle, and suture instrument. The trocars, with tubing attached, are kept apart, in a large basin. The ligature silk, of assorted sizes of finest Chinese twist, is kept on reels in carbolic lotion—the reel-stand already described (Fig. 13) is very convenient for this purpose—and ligatures are cut off as they are wanted.

These, or similar instruments, are absolutely essential; but few surgeons would care to begin operation without several other instruments being at hand, in case they are wanted. Among these might be mentioned:

- Koeberlé's clamp, with pedicle skewers.
- Cautery irons. (Paquelin's thermo-cautery requires a separate assistant.)
- Six glass drainage tubes—assorted.

A second dozen of pressure forceps.

Abdominal retractors.

Intestinal needles.

Each operator will probably like to have, in reserve, a few special instruments to which he has become accustomed: the writer, for instance, never likes to be without his crushing scissors. A Lister's sinus forceps, with points a little sharper than ordinary, is an excellent substitute for the needle which carries the ligature through the pedicle: the point is pushed through, the blades are separated, and they catch the ligature thread and draw it backwards through the opening made. Many surgeons use a director and a dissecting forceps. Special instruments for crushing the pedicle before tying it; an exhausting air-pump, attached to the trocar; peculiar needles for suturing the abdominal wound, and many other appliances, are in vogue; but the above may be taken fairly to represent the instrumental aids necessary to a skilful performance of the operation.



FIG. 44.

Sydney Jones's Cyst Forceps.

Some of the instruments require special description. Tait's pressure forceps (Fig. 16)—a modification of Koeberlé's—is superior to Wells's instrument in being more pointed, thus permitting the ligature to slip over it in tying adhesions, and in being more powerful in grasp. In other respects, the instruments are practically identical. The variety of forceps which I use is described above (Fig. 21, p. 92). Thornton's T-shaped forceps is a most useful addition to our hæmostatic agents. It is scissors-handled like the other catch forceps, with a rack catch, but differs in having the compressing blades set at right-angles to the handle. For holding broad adhesions, or compressing a piece of omentum which has to be secured with multiple ligature, or closing

a small rent in a cyst, Thornton's instrument is simply invaluable. I have found a very large forceps on the same principle most useful for like purposes. For firmly grasping and holding the tumour itself, the cyst forceps of Nelaton (Fig. 45) and of Spencer Wells leave nothing to be desired. Nelaton's

forceps, with its round, serrated, and spiked biting surfaces, maintains a grasp on the cyst-wall which is as powerful as the area it grasps can make it. Wells's large cyst forceps, on the same principle as his small pressure forceps, is perhaps less likely to cause tearing, and holds nearly as firmly as Nelaton's. It is made with straight and with bent blades (Figs.

17, 18, and 19). A size of Wells's forceps midway between the smallest and the largest will be found very handy. For all purposes of holding and handling cysts, the double



[FIG. 45.

Nelaton's Cyst Forceps. Half size.



FIG. 46.

*Wells's Clamp Forceps.
One-third size.*

hawk's-bill forceps which I use are very satisfactory. Wells's clamp forceps (Fig. 46) may occasionally be found useful for closing rents in the cyst, or for compressing large bleeding areas. The only advantage which they

possess over large pressure forceps is that they occupy less room. For evacuating the fluid, we have a choice of many trocars.

It is wise to have two instruments in readiness—one of large size, and another not very large. The two I

should select are Tait's large instrument (Fig. 47), with conical but not cutting point, and Wells's (or Fitch's) small instrument (Fig. 48), which is essentially a double tube, the outer one of which is the trocar—sharp and pointed, and the inner one is the cannula—blunt and extrusible. For a large thick-walled cyst, Tait's trocar is best. Wells's small puncturing trocar is suitable for small and multilocular cysts, and for those which have thin walls. Some amount of fluid usually escapes by the side of it;

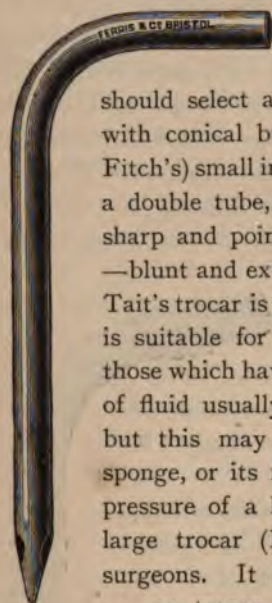


FIG. 47.

*Tait's Cyst Trocar.
One-third size.*

or trocar proper, cut obliquely and sharp at the point, for piercing, and an inner tube or cannula, blunt and cut square, which is pushed beyond the trocar by an attached thumb-piece as soon as the wall is pierced. To the sides of the trocar are attached two spring hooks or clasps, with sharp teeth which fit into pits on the trocar; these are intended to grasp the cyst-wall and pull it forward as the cyst empties. Volsella are usually required to pull the wall of the cyst under the hooks on the trocar. To the trocar is fitted a piece of india-rubber tubing of a calibre as large as that of the instrument, and long enough to reach the bottom of the vessel which is intended to receive the ovarian fluid.

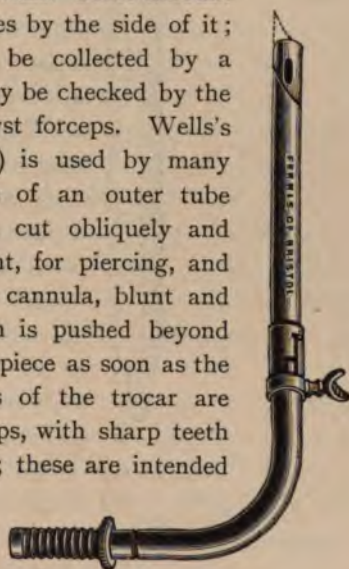


FIG. 48.

*Wells's Small Cyst Trocar, with Fitch's
Dome. Half size.*

A dozen sponges are prepared ready for use. They are selected as follows: one large flat sponge; four moderately flat sponges about six inches long and from three to five inches broad; and seven round sponges, of various sizes. They are kept in warm 1-40 carbolic lotion, and wrung out of this fluid by the nurse or assistant when required. As they are soiled they are handed to the nurse, who cleanses them thoroughly in warm water, and then places them in the warm carbolic lotion. A continuous supply of clean sponges is thus provided.



FIG. 49.

Tait's Cyst Trocar. Largest size—One-third size. Perforations close to point.

sponges. Laid over the abdominal wound under a bleeding tumour; coiled around a piece of intestine while it is being sutured; folded over omentum which has been stripped off a tumour, and in many similar ways, sponge cloths will be found very useful.

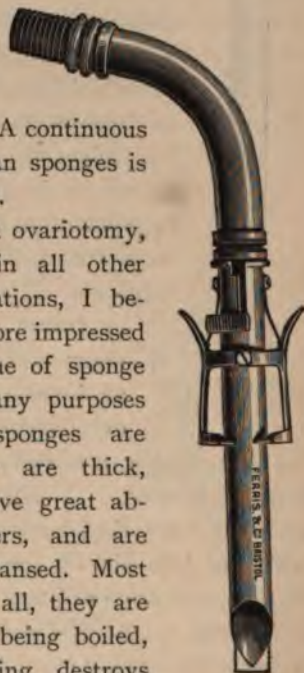


FIG. 50.

Wells's Large Cyst Trocar. One-third size.

The Parietal Incision.—The incision is made in the middle line between the umbilicus and the pubes. The structures divided are: the skin, the subcutaneous fatty layers, the linea alba, the layers of the fascia transversalis with the subperitoneal fat, and the peritoneum. The skin in this region does not usually present features of special practical interest. It may be firm and resilient, and intimately adherent to the subcutaneous fat; or it may be flaccid and soft, and readily movable over the underlying tissues. In the former case, it is easily divided in a straight line by the knife held in the first position; in the latter case, it may run before the knife, and will be most satisfactorily divided by pinching it up and transfixing it, as in herniotomy. The thickness of the subcutaneous fatty layer varies very considerably. In cases where there is much emaciation, it may be practically absent—the first incision exposes the fibrous aponeuroses; in very stout individuals the subcutaneous fat may be several inches in thickness. The thickness of this layer may be increased by œdema. In most cases the subcutaneous areolar tissue is divisible into two layers. The outer layer is pre-eminently fatty; the inner, mainly fibrous. Only in young subjects, however, is this distinction well marked. The vessels ramify chiefly in the outer fatty layer; usually they are quite small, but sometimes a moderately large branch is divided. The veins are occasionally large and tortuous, and sometimes bleed so freely after division as to require forcipressure or even deligation.

The linea alba is a structure of fairly constant composition and thickness. In muscular individuals with small tumours, the recti lie quite close to each other, and the linea alba is then little more than a fibrous partition; in thin subjects whose abdominal walls are distended, the linea alba may be stretched so that the recti are separated by half an inch or even more. In the latter instance, it is easy enough to divide the linea alba without opening the sheath of the rectus; in the former, this is a matter of some difficulty, and in practice one or both sheaths are frequently opened. Indeed, in some cases the linea alba is so narrow that division of it accurately in the middle line must result in exposure of both muscles. It must

be remembered that the posterior wall of the sheath of the rectus stops short at the falciform edge, and that the aponeuroses of the muscles below this—in the lowest fourth, that is to say—all pass in front of the recti. If the sheath is opened above this point, an additional layer of fascia, the posterior wall of the sheath, has to be divided before the subperitoneal fat is reached; below this point there is no additional layer, or only a thin fascia. As a matter of fact, the cavity is usually entered below the falciform edge; and if the opening is too small, it is extended upwards with scissors, when no account is taken of anatomical layers.

If the incision has to be carried above the umbilicus, it is wise to deviate a little way to the left, and not to pass through it. This is done partly to avoid the round ligament of the liver, which passes from the umbilicus obliquely upwards and to the right, and may contain an unobliterated umbilical vein, but chiefly because the tissues in the umbilical area are thin and liable to be cut through by the sutures if there is straining from sickness. Such an accident happened to me in a case of hysterectomy, and a large coil of intestine escaped. Fortunately the accident was soon discovered and no harm was done. The urachus, normally transformed into the vesico-umbilical ligament, may also be found pervious. Sometimes small openings exist in the linea alba, through which masses of fat protude (*herniæ adiposæ*).

The areolar tissue between the fascia transversalis and the peritoneum is very loose and elastic, and contains a varying amount of fat in its meshes. Its fibres can easily be teased apart, so as to expose the underlying peritoneum; and if it contains little fat, or if the peritoneum is adherent to an abdominal tumour, it may be mistaken for the tumour wall, and be separated from the parietes for some distance before the mistake is discovered. It may usually be separated into two or more layers.

The peritoneum varies in thickness according to idiosyncrasy, or as it is thickened by inflammation or thinned by distension. When there is much inflammation, the peritoneum may be a thick highly vascular tissue, which bleeds freely on division;

when the acuteness of the inflammatory process has subsided, it may be united more or less firmly, by organised bands of fibrous tissue, to the underlying tumour; and in this case also its vascularity will be increased. Generally speaking, an undue amount of bleeding during division of the parietes may be taken as indicating adhesion of peritoneum to intra-abdominal structures.

The first incision need not be longer than two or three inches, according to the thickness of the abdominal walls. The lower extremity of the wound is at a distance of two inches from the pubes. Lower than this it is not advisable to go, on account of the proximity of the bladder; if the opening is found to be too small, it is enlarged upwards. The amount of subcutaneous fat is estimated by touch, and the first incision divides skin and more or less of the fatty layer. One or two rapid cuts along the whole length of the wound complete the division of this layer, and expose the linea alba. Bleeding points are caught up in pressure forceps. A glance at the fibrous aponeurosis may, by showing a symmetrical arrangement of its fibres, indicate exactly the middle line. One or two dexterous movements of the scalpel divide the aponeurosis in the middle of the wound. If the muscle is exposed, a little movement of the divided fascial fibres over it will show on which side of the linea alba the opening has been made, and the rest of the division is completed, upwards and downwards, close to the middle line. This exposure of muscular fibre is of little practical moment. Indeed, for reasons already given, some operators prefer always to expose muscle, and more than one skilled operator recommends that the opening be made through the muscular fibres. The division is made by the knife alone, or by scissors; no director is required.

The loose transversalis fascia is now exposed. If it contains a considerable amount of fat, this is pushed aside and the peritoneum exposed by teasing. The deeper fibres of this fascia are usually divisible into several layers. These may be divided in various ways—by director and knife, by director and scissors, by scissors alone, or by forceps and knife. As a general rule, I think the last is the best plan. Where it seems to be feasible, the best plan of all is to pinch up fascia and peritoneum

between the forefinger and thumb; roll it from side to side to make certain that no bowel is included, and open the peritoneum by a minute incision, through which the blade of the scissors may be inserted to complete the division. The most generally applicable proceeding is, to catch up a small portion of fascia between two special peritoneal forceps and divide it between them, pulling the peritoneum outwards; if this does not effect an entrance, another little piece is caught between two pairs of forceps, pulled outwards and divided till the cavity is entered. The peritoneum is thus divided towards the outside, and all risk of wounding intra-abdominal structures is avoided. The completion of the opening is made by scissors, protected by the finger inside the abdomen. The forceps may, if so desired, be left lying on the abdominal wall attached to the edges of the peritoneum, keeping it everted, and preventing it from being stripped in the subsequent manipulations. For picking up the peritoneum, Spencer Wells recommends the use of Adams's double sharp hook. Before opening the peritoneum, all bleeding must be checked by forcipressure; and, after dividing the peritoneum, before proceeding further, its edges should be inspected to see that no hæmorrhage is going on.

The incision should be long enough to admit of the extraction of the collapsed and empty cyst without using force; that is to say, it will range between one and a half or two inches to eight or ten. The size of the tumour and the efficient treatment of adhesions alone should regulate the length of incision. While the chances of ventral hernia are diminished by a short incision, the actual difficulties of the operation should never be increased by working through a cramped opening. The rule to make the first incision long enough to admit the hand should be abolished: the length of the incision is to be regulated by principles more weighty than mere exploration, which is usually both meddlesome and unnecessary.

Emptying and Delivering the Cyst. Separation of Adhesions.—Some idea of the nature of the exposed tumour will have been rapidly formed by sight and touch. The characteristic appear-

ances, already described, of a cystoma and of a dermoid growth; the density, toughness, or friability of the cyst-wall; the nature of the contents as to fluidity or viscidty; the multiplicity of secondary cysts; and the presence or absence of adhesions or inflammation, will all be noted. A skilled surgeon will instantaneously decide as to the best practical means of dealing with each and all of such peculiarities in the growth to be removed; here it is possible to give only general directions.

Whatever be the condition, it is always best to begin by emptying the cyst. To explore with the finger is, in the great majority of cases, to satisfy curiosity rather than to help in the treatment. And to begin by separating adhesions, is a double mistake. By so doing, not only do we run the risk of rupturing the cyst-wall and letting the contents of the full cyst escape into the peritoneum, but we also deal with the adhesions at the most inopportune period, when there is little room for manipulation, and a likelihood of leaving bleeding points unsecured because they may not be seen.

The best mode of emptying the cyst is, in the large majority of cases, by tapping. When the growth is divided into a great number of cysts, or if the cyst-contents be very viscid, incision may be the best plan.

For a cyst of small size, the best tapping instrument is Wells's small cyst trocar (Fig. 48); for a large cyst, Tait's instrument, with blunt conical point, may be used (Fig. 47). Keith uses a very large exhausting aspirator, and this is probably the best plan of all. To prevent the escape of fluid by the side of the trocar, a sponge is all that is requisite. To keep the bowels from extruding the best plan is, not to push the abdominal wall backwards on the cyst, but to pull the cyst forwards on the edges of the opening. As the cyst becomes flaccid, large forceps are made to grasp the cyst-wall and pull it steadily but gently out of the wound. A flat sponge placed between the cyst and the parietes, may be useful in preventing the escape of fluid into the abdominal cavity. Secondary cysts may be emptied without removing the cannula from the main cyst; but, whilst this is being done, the fingers, inside the abdomen, should

make certain that the trocar is not pushed through the main cyst-wall. As the cyst becomes flaccid, the trocar opening is pulled over the edge of the wound; and as soon as it is clear of the abdominal opening, a fold of the cyst-wall, above and below, is caught in strong forceps, the trocar is removed, and the wall freely incised between the forceps, permitting the cyst contents to run over the macintosh into the receptacle below. Secondary cysts are broken down by two fingers inserted into the incision in the large cyst, or, if necessary, by the whole hand. Should bleeding be free during the breaking down of the septa, the incision must be prolonged, to permit of the whole tumour being delivered so that its pedicle may be compressed. If adhesions do not prevent it, the whole cyst is delivered as soon as it is sufficiently diminished in bulk; if adhesions do exist, they are divided as they come into view, in a manner to be presently described.

When it is deemed advisable to evacuate the cyst contents by incision (a few surgeons always adopt this method), two large catch forceps are attached to the cyst-wall, opposite the ends of the wound, and an incision made between them, while they are forcibly pulled forwards, so as to keep the cyst-wall in contact with the parietes. Interposed flat sponges gather up any escaping fluid. The cyst-wall is sometimes so tense that it is not easy to get a grip by the forceps; in this case, as much as possible is first pinched up by small forceps, and the large forceps are placed below the fold thus made. Dermoid cysts are in most cases best emptied by incision.

If, after emptying the cyst as completely as possible, adhesions prevent its being delivered, a large T-shaped forceps is placed on the opening, so as to close it, and the important steps of separating the adhesions are begun. For separating very soft, fine, and recent adhesions, nothing is better than a sponge. The adherent organ is, so to speak, sponged away from the tumour, and the sponge is left overlying the adhesions it has pushed aside, so as to absorb any blood that may ooze from the divided minute vessels. Adhesions of firmer consistency are dealt with in various manners. If comparatively recent, they may be carefully peeled

off the tumour with the fingers, while forceps are applied as often as necessary and left attached. If the adhesions are old, fibrous, and thick, they are surrounded by ligatures and divided. Speaking generally, soft adhesions which may be sponged off are usually found on the parietes or the liver; adhesions which may be peeled off by the fingers are most frequently omental; and division between forceps is in most cases required when bowel is attached to the tumour. Attachments to uterus and bladder, if they exist at all, are usually intimate and dense, and their separation requires care and judgment.

Wherever it is possible, forceps are brought out through the wound and left there while the soft tissues are placed between the folds of a flat sponge or thick sponge-cloths. And, generally, as the separation proceeds, sponges are placed in every gap made between the tumour and the detached organ. When the whole tumour is delivered, a large sponge is placed over the bowels, to protect them and to prevent their escaping.

During the separation of adhesions the walls of any of the hollow viscera may be torn. Such lacerations must, of course, be immediately closed by suitable sutures. If at any point the connection to bowel or bladder is so intimate that complete separation seems fraught with danger to the integrity of the organ, then the adherent portion of cyst-wall must be cut off and left behind. In removing a very large, suppurating, putrid, and universally adherent Fallopian cyst, I had to leave behind a considerable portion of the thick cyst-wall in a matted mass of inflammation sessile on the left iliac vessels and the sigmoid flexure. After drainage and daily syringing for more than a month this came away through the drainage opening as a slough which filled a three-ounce bottle. A fæcal fistula resulted, which spontaneously healed. Considerable portions of uninflamed and healthy cyst-wall may be left behind without incurring risk.

For the management of many abnormal conditions which are constantly arising in bad cases, definite instructions can scarcely be given. Such instructions would be as endless as the complications; they could never be exhaustive. If broad guiding principles are fully mastered, and the surgeon has a fair knowledge of

the general surgery of the abdomen, he may safely be left to manage the ordinary complications met with in ovariectomy.

Treatment of the Pedicle.—The pedicle has been subjected to almost every conceivable surgical treatment. "It has been tied entire, tied in sections, been twisted off, burnt off, crushed off, cut square off, cut off in flaps, left inside, left outside, and been made to slough off." *

It has always seemed to me that this *questio vexata* of ovariectomy has been unduly magnified in importance. To a surgeon accustomed to deal with amputated limbs the pedicle is, comparatively, a small matter. A few small vessels to supply a pound or two of not very vascular tissue, with slight fluid-pressure and little foreign material around them, ought not to alarm us. We rarely have a vessel larger than the radial to deal with, and very rarely one that will spout a stream to a distance of six inches.

* Sutton, *Trans. Amer. Gyn. Soc.*, 1883, vol. vii., p. 119.

From this source is derived the following instructive historical summary of the treatment of the pedicle in ovariectomy :

- 1809. McDowell tied with single ligature, and left ends outside.
- 1820. Chrysmar of Würtemberg tied in two portions, leaving ends out.
- 1821. Nathan Smith tied arteries separately with strips cut from kid glove, cut ligatures short, and dropped in pedicle.
- 1837. Stilling of Cassel used cautery, and suggested stitching pedicle in wound.
- 1846. Handyside of Edinburgh carried ligatures through Douglas's pouch into vagina.
- 1848. Stilling treated pedicle outside peritoneal cavity.
- 1850. Duffin, London, began Stilling's plan in England.
- 1849. Maissonneuve of Paris twisted the entire pedicle.
- 1850. Atlee used the *ecraseur*, and many followed him.
- 1850. Hutchinson invented clamp.
- 1860. Sir James Simpson, acupuncture inside abdominal wall.
- 1865. Koeberlé invented his *serre-nœud*, or wire-constrictor, with which he grooved the pedicle prior to ligation.
- 1864. Baker Brown used Stilling's cautery.
- 1868. Masslovsky, double flaps, and stitched them.
- 1869. McLeod of Glasgow, torsion between two pairs of strong forceps.
- 1870. Emmett, 18 cases treated with silver wire.
- Billroth catches pedicle between two forceps, ligatures, and divides with thermo-cautery.
- Nussbaum ties pedicle in sections with catgut and drops in.

The cases are few indeed where the whole of the vessels may not easily be compressed between the fingers. True, the very facts that the blood-pressure in the vessels of the pedicle is low, and that the vascular walls are thin, are against their capacity for self-occlusion by the ordinary pathological process after deligation. If hæmostasis is easy, it must be thorough and all-embracing. But it need not be overdone.

At present we are practically left to choose between two methods of securing the pedicle, both almost perfect—the ligature, complete and intra-peritoneal; and the clamp and cautery. It is almost certain that extra-peritoneal treatment by the clamp is now permanently abolished, and I shall not describe it. With scarcely an exception, there is no sort of pedicle which can be clamped that may not be tied; and almost any form of deligation is as good as any method of clamping.

In the hands of Keith, the method of *cautery and clamp* has reached perfection as nearly as any surgical procedure can. The minute accuracy of his manipulation, leaving a thin, grey, translucent band of anæmic but still living tissue, few surgeons can hope to equal, and certainly none to excel; and, in face of the undoubted safety of the more easy and rapid ligation, I doubt if many surgeons will seek to imitate him.



FIG. 51.

*Keith's Cautery Clamp.
One-third size.*

The clamp which Keith uses is essentially that introduced by Baker Brown in 1864. (Fig. 51.) Two flat steel bars, each provided with a powerful handle, are joined at their distal ends by a strong hinge; on their under surface are two thick ivory plates, which extend a little way beyond the metal and act as non-conductors. On the left blade is fitted an upright guard, against

which the cautery may be pressed, so as to prevent slipping. The cautery irons are very large, so that they retain their heat for a long time, and they are variously shaped (Figs. 52 and 53) to suit the nature of the work. A hatchet-shaped cautery may be used for cutting through the pedicle, pressing it into the angle formed between the guard and the clamp. Disc-shaped cauteries are used for smoothing down and finally coagulating the seared edge. The cauteries, of which there should be two or three at hand and ready for use, are heated in an ordinary coal fire.

In using the cautery clamp, the pedicle is laid out at a convenient distance from the tumour between the blades. The tissues in the pedicle are left undisturbed as far as possible; compression is put upon them in the position which they naturally assume, and there is thus no tendency for the pedicle to untwist. The blades are tightened up by the screw as firmly as possible. Then the tumour is cut off with scissors about half an inch from the clamp. Before applying the cautery to the pedicle, wet cloths are laid around the clamp under the ivory, so as to prevent over-heating of the neighbouring tissues.

The cauteries used must be as hot as possible. They are rubbed up and down the blades of the clamp against the upright guard, till the line of compressed pedicle lying between the steel blades is perfectly smooth and level. No black charred tissue is left behind to slough; when efficiently dealt with, the stump terminates in a thin grey margin of dry semi-translucent tissue, not unlike cartilage in appearance and consistence. The clamp is removed with cir-



FIG. 52. FIG. 53.
Cautery Irons for Searing
Pedicle. One-third
size.

cumspection, catch forceps being placed at each side of the pedicle, to prevent its slipping into the abdomen. Sometimes a seared vessel sticks to the blades of the clamp, and may be torn through if the blades are roughly removed.

The *silk ligature* is now almost universally used for securing the pedicle. There is no objection to catgut, beyond the extra trouble necessary in preparing it; I have used it successfully in a good many cases, but have now given it up for silk. And, as far as written records may be trusted, no special virtue resides in any form of silk, provided it be strong and pure. Chinese twist, of thickness varying according to the size and vascularity of the pedicle, is most generally used. It is first scalded in boiling water, and then soaked in antiseptic lotion. There are many methods of tying the ligature; no method, in my opinion, is superior to Lawson Tait's Staffordshire knot. (Fig. 54.)



FIG. 54.

Tait's Staffordshire Knot.

"An ordinary handled needle, armed with a long piece of the silk required, is passed through the pedicle and then withdrawn, so as to leave a loop on the distal side. This loop is then drawn over the ovary or tumour, and one of the freed ends drawn through it, so that one end is above, while the other is under, the retracted loop. Both ends being seized in the hand, they are drawn through the pedicle, against which the thumb and forefinger of the left hand are pressed, as a fulcrum, till complete constriction is made. A simple hitch is then made, as in the drawing, and tightened; and that is followed by another, as in ordinary ligature-tying. There is another and more complicated way of making the knot, by passing each end of the thread round the corresponding half of the pedicle, and crossing them within the loop in front, which is equally effective, and which may be used in cases of large solid tumours. But the former is by far the more elegant and rapid method."

The advantages which Tait justly claims for his knot are, that "while it ties the pedicle in two halves, these halves are

compressed really into one surface; the two halves are equally well compressed; and from the mechanical arrangement of the knot, very great constricting force can be employed."

The Staffordshire knot is, as every ligature applied to the pedicle should be, an interlocking one. Ligatures should never be applied to the pedicle in sections so as to split it. Such splitting extends downwards some way below the site of deligation, and may pass through a thin-walled vessel which may bleed very freely.

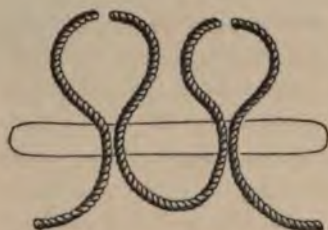


FIG. 55.

Triple Interlocking Ligature. The threads inserted.



FIG. 56.

Triple Interlocking Ligature. The threads interlocked ready for tying.



FIG. 57.

Triple Interlocking Ligature Tied.

In some cases of thick or broad pedicle, double deligation by the Staffordshire knot may not seem sufficient; then ligation in three or four portions may be advisable. In such a case the threads must be interlocked so that the pedicle, while it is tied in sections, is still compressed as a whole towards its centre, and splitting is thus rendered impossible. The accompanying diagrams (Figs. 55, 56, 57) show how easily and rapidly this may be done, when we desire to make deligation in three portions. A piece of silk long enough to form three ligatures is threaded in the blunt pedicle needle. The needle is passed, at about a distance of one-third of the breadth of the pedicle from one of its

margins, through an area in which there are no vessels, or from which the vessels have been pushed aside; the silk is caught in a loop over a finger of the left hand, and the needle withdrawn still threaded. It is re-inserted midway between the

point of insertion and the other margin, the loop is caught up on another finger, the needle is withdrawn, unthreaded, and laid aside. The pedicle is now transfixcd by a continuous ligature, which has two loops showing on one side, and one loop and two free ends on the other side. (Fig. 55.) The two free ends are now passed under the loop lying on their own side. (Fig. 56.) The two loops on the other side, still held on the fingers, are now divided by scissors, and the ends of the middle ligatures surrounding the middle of the pedicle, and including the ligatures which surround the two sides of the pedicle, are tied as tightly as possible. The lateral ligatures are then tied one after the other. Thus a complete interlocking ligature holds the pedicle. (Fig. 57.) The same process may be carried out with four or five, or indeed any number of ligatures.

It is always wise to use a blunt needle for transfixing the pedicle, as there is often some risk of wounding vessels. I use a bent finely-pointed forceps, like a Lister's sinus forceps (Fig. 58) for this purpose; the forceps with blades closed is pushed through the pedicle, the blades are opened and the thread is caught between the blades and pulled backwards through the opening. If the pedicle is very bulky, it may be advisable to squeeze it in a temporary clamp, or between the blades of powerful compressing forceps at the site of deligation, before tying the thread. Bantock in particular uses this method, employing two powerful Wells's forceps, bent at an angle for the purpose. The needle or forceps transfixes the pedicle near the tips of the blades, and the ligatures are tightened while the forceps are being removed. Such compression drives the fluid out of the tissues at the point where the ligature lies, and prevents their slipping away from under the encircling



FIG. 58.

*Forceps for placing Pedicle
Ligature.
One-third size.*

thread. In thick œdematous pedicles this plan is valuable, and should be always adopted; for ordinary pedicles, experience has abundantly shown that it is at least not essential. It is possible

to overdo crushing of the pedicle; there is undoubtedly some theoretical force in the reasoning of Thornton and Doran, that over-compression is likely to lead to sloughing. But, as a matter of fact, it would appear that no positive harm arises from the almost universal practice of pulling the ligatures as tightly as possible. It will always be found that in fleshy or œdematous pedicles the ligature may be drawn more tightly after the tumour is cut away. While the first hitch is being drawn tight the pedicle is cut through about half an inch above the ligature by successive snips of the scissors cutting from periphery to centre; the tissues at once become softer, and the thread may be drawn in more tightly. But this is rarely necessary. With Tait's knot, very ordinary force will be amply sufficient to render hæmostasis complete and permanent.



FIG. 59.

*Galabin's Pedicle
Needle.*

Experienced operators use other modes of securing the pedicle by ligature. But, for simplicity and efficiency, no methods are superior to those described.

A single thickness of silk, placed by transfixion as described, and secured by a true reef-knot, will suffice for the great majority of pedicles. Extra ligatures, to provide against the chance of hæmorrhage, import a new danger in the risk of their not becoming absorbed or encapsuled. The thinnest silk



FIG. 60.

*Wells's Pedicle
Needle.*

compatible with safety, the smallest knot, and the least possible handling of the pedicle, is the most perfect surgery.

The pedicle, secured and divided, is dropped into the cavity, and, in most cases, need not be again looked at. If there is any doubt as to its being properly secured, a catch forceps may be attached to the stump, whereby it may be drawn to the surface and inspected before finally closing the wound. The sponges, however, which are subsequently carried into Douglas's pouch will scarcely fail to show if there is bleeding from the pedicle. At this stage the alternate ovary should be inspected. If it is diseased, it should be removed.

Cleansing the Peritoneal Cavity.—One of the most important steps in the operation is the complete removal of all foreign material from the cavity—the “toilet of the peritoneum,” as it has well been called. McDowell himself partially anticipated this proceeding; but to Keith we are indebted for fully demonstrating its extreme value. The modes of carrying out this proceeding are the same for all abdominal operations, and need not again be fully described. With a suitable sponge-holding forceps, sponges are successively carried into Douglas's pouch and into the hollows of the loins; and they are reintroduced till they return dry. If glutinous or semi-solid foreign matter is present, Tait's excellent plan of washing out the abdomen by warm fluid should be adopted. If there is no special apparatus, the rubber tubing of the trocar, to act as an irrigating tube, and a basin or ewer to hold two or three quarts of fluid, will suffice. The wound is kept as close as possible with one hand, while the fingers of the other are moved about among the intestines, washing and cleansing them thoroughly. The process is continued till the fluid returns clear. Dry sponges are then placed in the pelvis and in the loins, to be removed after the sutures have been inserted, but before they have been tied. In many cases the fluid may be poured in from a jug.

It is impossible to insist too strongly on the importance of removing all foreign matter from the peritoneal cavity. But a judicious balance between efficiency and excess must be

observed here, as well as everywhere else. Too much sponging may irritate the peritoneum; one may go on for a considerable period squeezing out a few drops of fluid from the sponges, which contain nothing more than peritoneal secretion thrown out from irritation. And if the patient is seriously collapsed from a prolonged operation, it may be wise, in balancing possible evils, to curtail the cleansing of the peritoneum, and either run the subsequent risks or drain.

Drainage.—The question of drainage is a very difficult one to speak about in theory. In practice, a good rule to follow is, "When in doubt, drain." If little or no fluid comes away through the tube, it may be removed in twenty-four hours, and no harm is done. If fluid does come away, we have the satisfaction of seeing that a danger has been avoided. Fewer cases have died from drainage than from the want of it.

In cases with deep pelvic adhesions, the bleeding from which it may be impossible to see or effectually to control, drainage is specially indicated. Where a raw surface has been left behind—on bladder, pelvis, or parietes—we may expect subsequent sero-sanguinolent oozing, and we drain if we expect the amount to be considerable. In any case where putrid fluid had escaped into the cavity we should be careful to drain. If, generally, we apprehend an excessive secretion of fluid, or if we are in doubt as to the peritoneum being thoroughly cleansed, drainage ought to be adopted.

Keith's glass tubes (Fig. 37) are the best for use after ovariectomy. The tube must not be too long nor too short. The end of it should touch the bottom of Douglas's pouch, without pressing upon the rectum; while the collar rests upon the edges of the wound, at its lower extremity. Pressure must not be put on the tube by dresser or binder. The end of it is passed through a button-hole opening in a sheet of rubber; over the end is placed an absorbent dressing; and in the tube is placed a twisted roll of gauze, to exhaust fluid by capillary action. If capillary action and intra-abdominal pressure do not

remove the fluid from the abdomen, then a suction apparatus, such as Tait's (Fig. 38), must be used at frequent intervals.

Suturing the Wound. Dressing.—Little need be added to the general remarks already made on these points. At the lower extremity of the wound the first suture is placed very carefully, so as to close completely the opened connective tissue spaces, and the peritoneum is here brought together with special accuracy. The needle is inserted about two lines from the edge of the wound, and picks up fascia, then passes deeply into muscle, then picks up areolar tissue under peritoneum, and does the same in reverse order on the opposite side. If my handled needle is used, the silk-worm gut is passed through its eye after insertion and placed during withdrawal. When the sutures have been inserted, and the underlying sponge removed, the wound is finally sponged free of all blood, while it is pulled outwards by the sutures gathered together in the hand. The sutures are accurately tied and their ends cut off. For dressing, a pad composed of four thicknesses of boric lint, and held in place by long strips of strapping which encircle the abdomen, is as good as any. The advantages claimed for strapping over the whole lower abdomen, fixing its walls as in a splint, and preventing passive gaseous distension, need not be recapitulated. I have practically given up the binder, as I believe it causes more annoyance, from getting into folds under the patient's back, than the little good it does is worth. Putting on the binder, as the completion of every form of surgical interference with the abdomen, is a time-honoured observance; it is difficult to say how much more it is.

INCOMPLETE OPERATIONS.

Contrary to what might be expected, the number of incomplete operations would seem of late years to be on the increase. Terrier, in 25 recent operations, left no fewer than five uncompleted. Homans, in 290 cases, stitched the cyst to the parietal opening in eight, and all are said to have recovered. It is

not said that they were cured of their disease. Occasionally it may be advisable to leave behind a small portion of cyst-wall densely adherent to an important organ; but very rarely can it be proper to relinquish the operation while the glandular growth is unremoved. To do this last is simply to abandon the patient to death. If surgeons of the greatest experience and success hold, as they do, that there is no cystic growth of the ovary which cannot be removed; others, who fail to act upon this creed, entail on themselves a heavy responsibility. It is not argued that a surgeon is necessarily guilty who fails to completely remove an ovarian cystic growth; but he ought to be able to give very cogent reasons for his failure. I have never left an ovariectomy uncompleted; many times, however, have I wished that I might do so.

ACCIDENTS DURING THE OPERATION.

Escape of Intestines.

Stripping the Peritoneum.

Tearing the Cyst-wall.

Injuries to the Hollow Viscera.

Injuries to the Solid Viscera.

Foreign bodies left inside.

Mishaps may occur during the most simple ovariectomies; they are especially frequent in difficult cases. It behoves the surgeon to be able, promptly and efficiently, to deal with these; for such accidents, unattended to, may involve consequences far more serious than the operation itself.

Vomiting and retching during operation is a disagreeable complication. The straining, which is sometimes quite violent, tends to force the intestines out of the wound. While the cyst is being emptied, merely dragging it forwards, so as to keep it in close contact with the abdominal wall, will probably suffice to keep back the bowels. As the cyst collapses, its place may be taken by large sponges, packed round the

abdominal opening. Sometimes it will be necessary to cease operating, and temporarily to close the wound by hooking the forefinger under the upper extremity of the abdominal opening and squeezing the walls together between the thumb and fingers. The force of the contracting abdominal muscles is sometimes enormous, and requires considerable exertion to oppose it.

Stripping the Parietal Peritoneum is an accident likely to occur only with inexperienced operators. In thin subjects the peritoneum may be peculiarly well defined, while it is loosely attached to the abdominal wall; and if, in addition to these peculiarities, it is adherent to the underlying cysts, it may be peeled off the parieties to a considerable extent before the error is discovered. In such a case it is better to cut the peeled flap clean away, than to leave it to run the risk of becoming gangrenous.

Tearing of the Cyst-wall and escape of the cyst-contents into the cavity is not a serious accident, unless the contents are putrid. A large tear at the site of puncture is best managed by grasping the edges of it with forceps and pulling the opening out of the wound. A laceration elsewhere is either closed by forceps, or, if large, is surrounded by flat sponges. Bleeding from such tears is sometimes profuse, and must be treated by immediately delivering the tumour and securing its pedicle.

Injuries to the Hollow Viscera are likely to occur only when there are dense, strong adhesions between them and the cyst-wall. The walls of any part of the intestine may be torn through; such a tear must be stitched up before doing anything else. Removal of a considerable portion of mesentery, incurring a risk of gangrene of the intestine, raises the question of resection. I have had to remove the vermiform appendix, for injuries done to it during operation. Rupture of the bladder, if properly treated by accurate suturing, is not so dangerous an accident as might be supposed. I have wounded the bladder somewhat extensively on three occasions, once followed by free escape of urine; in no case did any harm result. If the gall-bladder is ruptured, we may, according to the extent of the injury,

either remove the whole viscus or establish a fistula; to stitch up the laceration is not always safe. Rupture or division of the ureter is a serious accident. The ureter has been included in a ligature more than once. Only once (Nussbaum's case) after such injury to the ureter during ovariectomy has permeability been restored; if the patient does not die, a fistula remains, which can be cured only after removal of the kidney, or a special operation on the ureter. The manner in which a divided ureter is treated is fully described further on under the surgery of the ureters and need not be described here.

Injuries to the Solid Viscera—liver, spleen, or kidney—are not common. If bleeding continues after sponge-packing, the raw surface must be mopped with iodine or perchloride of iron solution. A serious injury to the kidney involves risk of urinary extravasation, and the best treatment may be nephrectomy.

Foreign Bodies—instruments or sponges—may be left in the abdominal cavity. The best preventive is the use of a definite number of each sort of material, and counting after operation. The counting of the instruments would seem to be a simple enough proceeding; yet it is a fact that no one but the operator himself can be made to recognise the vital importance of being absolutely exact in this duty. Time after time have skilled assistants and nurses been found at fault; and this petty duty, like every other one, is almost forced upon the operator. It is a good plan to make the assistant count the items aloud in the hearing of the operator; and if the surgeon has secretly abstracted one or other of the instruments, it will add to the security. A foreign body must of course be removed as soon as it is certain that it is left behind.

ENCAPSULATED OVARIAN CYSTS.

Doran has given this name to ovarian cysts which grow between the layers of the broad ligament and carry it, along with the pelvic peritoneum, upwards into the abdominal cavity. The capsule on exposure is of a pale red colour, contrasting with the glistening white appearance of the underlying cyst-wall.

The cyst is tapped and delivered in the ordinary way. Should the capsule completely envelop the cyst, and show a marked constriction between the uterus and the tumour, the whole of it may be removed with the tumour, and the constriction treated as an ordinary pedicle. More commonly, however, the tumour is not completely encapsuled: it has burrowed downwards into the pelvic fascia, and the broad ligament and pelvic peritoneum may be but slightly disturbed from their connection with important organs. Then the tumour must be shelled out from the capsule; and the capsule must, in whole or in part, be left behind. Whilst the collapsed cyst is being dragged upwards by the assistant, the operator peels off the capsule by sponging and tearing, placing forceps on bleeding points, till the true pedicle, which is represented by a few large vessels at the bottom of the tumour, is reached. The vessels are tied and the tumour is cut away.

The empty capsule, if it can be drawn together at the base, and has no important outlying connections, may be cut completely away after deligation. If it lies very deep, or has a broad base, or is intimately connected with important structures, it may be necessary to leave the whole or a portion of it behind. If the cavity left after removing a portion of the sac is small, and there is no oozing, the edges may be drawn together by a continuous suture and the abdominal cavity closed over it. Usually, however, there is some oozing, and then it is wise to stitch the edges of the capsule, gathered together by a purse-string suture, to the bottom of the parietal wound and insert a drainage tube.

TREATMENT AFTER OVARIOTOMY.

One of the first lessons that experience teaches in ovariectomy is the futility of all fussy regulations as to feeding, medicines, catheterism, posture, and such like. It is wise, for the first twenty-four hours, to give nothing but small quantities of hot water, or hot toast-water, or tea, or weak soup. In the next twenty-four hours, a little oatmeal gruel, or Brand's essence

of meat, or similar preparation, may be given with the water. Thereafter, if the case is doing well, the patient may have almost what she asks for. Milk as food is to be avoided; sucking ice for thirst usually results in accumulation of fluid in the stomach, which is rejected. Thirst is usually considerable after these operations: the best way to allay it is to administer a pint of tepid water by the rectum. Often, after such an enema, not only is the thirst relieved, but the patient breaks into a gentle perspiration and falls into a refreshing sleep. The best foods, from the third day to the fifth or sixth, are: arrowroot, sago, oatmeal-gruel, ordinary beef-tea, and such like. A cup of tea with thin bread and butter is often much appreciated. At the end of a week the patient may have ordinary diet.

All medicines are, if possible, to be avoided, particularly opium. Pain I believe to be not so strong an indication for opium as restlessness. Sickness and tympanites are predisposed to, if not often caused by, opium. One expects, after the first dose has been administered, to see the patient wake up in the morning with a dry tongue, increased thirst, and some feeling of pausea, which during the day do not pass off, but culminate in restlessness at night, requiring the administration of a second dose. We rarely see a case treated throughout with a perfectly flat or retracted abdomen if opium has been administered. When the patient tosses about in bed, fidgety and restless, without any particular symptoms beyond those incident to a serious operation, opium is undoubtedly of great value. Many surgeons administer the opium by the rectum, and leave its administration to the discretion of the nurse: I believe that a hypodermic injection of morphia, administered by the surgeon himself, is a more satisfactory and efficient method.

Of other medicines, all that need to be kept in readiness are, a saline purge—a Seidlitz powder is as good as any—and turpentine for giving in enemas. Of all the effects of therapeutics, none is perhaps more striking than that following the exhibition of a saline purge, supplemented, if necessary, by a turpentine enema, in abdominal distension, on the third or fourth day after ovariectomy. Such distension is usually taken as indicating peritonitis,

and so, no doubt, it sometimes is; but this is no contra-indication—rather the reverse. For moderate degrees of flatulence, wearing the rectum-tube is usually quite sufficient; in greater amount, the flatus may be removed by a hot-water enema, with or without turpentine; when the abdominal walls begin to become brawny, these means ought to be supplemented by a purge. Opium, except in the special circumstances mentioned and in others to be noted, is in such conditions to be avoided.

The urine need not be drawn off till the patient asks to be relieved, and this may not be for twelve hours or even longer. The secretion of urine, in these cases, is at first scanty; from ten to fifteen ounces in the first twenty-four hours is about the average amount. The full amount is not usually secreted till five or six days have passed. Catheterism once on the first day, and twice or three times on the second, will usually be all that is required; thereafter the patient will probably be able to pass water herself. Frequently the catheter is never required at all; if the patient can pass her water she is permitted to do so from the beginning. To ensure absolute cleanliness of the catheter, and avoid the risks of vesical catarrh, it is wise to give the nurse a metallic or glass instrument which can be purified with certainty.

From the beginning the patient may be permitted to lie in whatever position is most comfortable, the nurse moving her. If the abdomen is supported by strapping, this change of position involves no risk. I have often seen a patient, wakeful in the supine position, drop off to sleep at once when turned on the side. Raising the limbs on pillows, elevating the head and shoulders, and numerous little attentions of this sort, which an intelligent and conscientious nurse will observe, all add to the patient's comfort. The advantages of two beds, one for the day and one for the night, are self-evident.

The condition of the wound may be absolutely ignored till the seventh or eighth day, when, for the first time, the dressings are removed. Almost without exception the wound will be found perfectly healed. Stitch-abscesses ought never to occur. They are caused either by filthy sutures, or by tying them too tightly. I now, for reasons given above, leave the stitches *in situ* for three

weeks, or even longer. The wound area may be thoroughly washed, a fresh pad of boric lint placed over it and the strapping replaced. It is wise not to let the patient get up within the fortnight, however much she may desire it.

Such is the ordinary treatment of a simple, straightforward case of ovariectomy; and the large majority of cases proceed in this satisfactory manner. In skilled hands, the average case goes on, almost as a matter of course, in an uneventful manner; only difficult and severe cases are expected to be followed by serious illness. We often see cases recorded as severe which recover "without a bad symptom." Every genuinely severe operation must be followed by grave symptoms; and it is in the saving of such cases after operation, almost as much as by skill in the operation itself, that the greatest triumphs in abdominal surgery are secured.

The first danger to be surmounted is shock with collapse. This is combated on ordinary principles by hot-water bottles, warm blankets, elevating the limbs, stimulating enemata, and, if necessary, by hypodermic injections of ether or brandy. In such cases feeding by the mouth is out of the question. In every bad case rectal feeding and stimulation should be begun almost from the moment the operation is concluded. Nutritive enemata with brandy, graduated according to necessity, administered every few hours for the first forty-eight hours or so, will tide the patient over the first stage. Restlessness and jactitation are here best treated by full hypodermic injections of morphia.

All cases of severe operation are of necessity followed by more or less peritonitis. The symptoms of peritonitis appear from the second to the fourth day, and manifest themselves by sickness, vomiting, and tympanitic distension of the abdomen. The pulse is small, wiry, and rapid; the breathing is quick, superficial, and entirely costal; the countenance becomes dusky, the lids blue, and the aspect generally that indescribable but characteristic one which is familiar to every experienced operator. Therapeutic measures must now be prompt and decisive, and of vigour corresponding to the gravity of the case.

In the first place, the administration of all foods, drinks, and medicines by the mouth must be stopped. They are simply vomited, and perseverance in their exhibition is bootless, and only worries the patient. A definite system of feeding by the rectum is at once instituted and continued. A good routine enema is, an ounce of brandy, a teaspoonful of Valentine's fluid meat or Brand's essence or Benger's peptonised jelly, and four ounces of peptonised milk; to be administered every four or six hours. Once in the twenty-four hours a pint of tepid water is passed into the bowel: much of it is absorbed and relieves thirst; some of it may be returned with flatus and the residues of the enemas. For half an hour or more at a time before the period when an enema is due the rectum-tube is worn, and much flatus may pass through it. If morphia is given at all, it must be given in full doses and continuously, so as to keep the patient semi-narcotised. If the distension is excessive, causing dyspnœa, a large turpentine enema, or, perhaps better, repeated small turpentine enemas are of conspicuous benefit. Though it is not always possible to give it on account of the vomiting, it must not be forgotten that the greatest good will probably follow a saline purge: liquid and flatus may be passed in enormous quantities, to the patient's great relief.

In the worst cases, passage of the stomach-tube may be called for. I have more than once seen the passage of this tube in cases of extreme distension followed by a forcible ejection—almost an explosion—of fluid and gas that produced instantaneous relief. Once or twice a day the patient may be encouraged to drink a large amount of hot water or hot tea, with the purpose of causing free vomiting. A free vomit is less exhausting than continual retching, and it is highly effectual in getting rid of intestinal accumulations.

When it is evident, after two days of this treatment, that the patient is losing ground, that the distension increases and the vomiting continues unabated, I believe that we ought to reopen the wound and wash out the abdomen with a stream of warm saline or antiseptic lotion. Two or three stitches at the bottom of the wound are removed, and two fingers are gently insinuated

amongst the bowels. A celluloid catheter attached to a piece of rubber tubing, coming from a cistern elevated a few feet above the level of the patient, conveys the fluid into the cavity. The fingers move the bowels about, while the stream of fluid cleanses the peritoneum. Probably the bowels will be glued together at one part or everywhere by soft adhesions: these are broken down by the fingers. If a drainage tube has not been used, it is now inserted. It is unnecessary to sponge out the peritoneum, unless a collection of septic pus is discovered—an unusual accident in these days. I believe that these cases die as much from a form of intestinal obstruction induced by the adhesions and the distension, as from mere peritonitis. A separation of these adhesions, setting the bowels free and keeping them floating in non-irritating boric lotion or similar fluid, gives the patient a chance of life which is by no means a remote one. No case ought to be permitted to die without giving it this chance of recovery.

With reference to subsidiary details in treatment, little need be said. If drainage is used, the dressing which collects the fluid is changed as often as necessary, not less frequently than twice a day; and the most scrupulous care is given to keeping those dressings, and every part with which the fluid comes into contact, sterile.

As regards the temperature, I truly believe that it is the least important of all the signs. Case after case occurs in which the temperature after the second day becomes and continues absolutely normal. A rise on the second day to 99.5° or 100° is the rule; in the simplest cases this rise is usually higher; in the worst cases there may be no rise at all, or even depression. It is better to have elevation than depression of temperature in the first few days. A rise later on indicates some inflammation, probably of a simple traumatic nature: the most severe cases of peritonitis are associated with lowered temperature. The employment of mechanical or therapeutic measures for the lowering of temperature after abdominal operations is very rarely called for.

Solid and Malignant Growths of the Ovary.

Solid tumours of the ovary are rare. Of all tumours of the ovary, probably not more than three per cent. are solid. Most of them are malignant, sarcoma or cancer: true myoma has been found; pure fibroma is almost unknown. Doran has never met with fibroma. Tait says that "growth of the fibrous stroma of the ovary, so as to form a large abdominal tumour requiring removal, has not yet been described." I have, however, successfully removed a solid ovarian tumour as large as a child's head, in which repeated examinations by competent histologists failed to show any other histological element than pure fibrous tissue. Pain was the most prominent symptom in this case. Curiously, in the only other case recorded before 1891 pain was described as being very intense. Since then a few more cases have been described, pain being a common symptom. Two reported by Mr. Ch. Martin* had in one severe dysmenorrhœa and in the other symptoms of pressure on bladder and rectum. The so-called ovarian fibroid is usually a pure myoma, though we have the authority of Virchow for believing that considerable amounts of pure fibrous tissue may co-exist with the muscular fibres. Cysts have been found in these tumours; and Waldeyer† has recorded a case which was almost completely transformed into bone.

Malignant growths are either sarcomatous or cancerous. Papilloma of the ovary—a very rare disease—may also be reckoned among malignant growths. Sarcoma is usually of the spindle-celled variety. The blood-vessels are usually of very large dimensions, giving the divided tumours almost a cavernous appearance, and cysts are frequently found containing blood or serum. In one case recently operated upon, I shelled out nearly a bucketful of blood-clot from the centre of a sarcomatous growth. In another case both ovaries, each as large as a fist (now in the Bristol Infirmary Museum), were sarcomatous, and the peritoneum was studded with innumerable nodules,

* *Brit. Gynec. Journ.*, vol. x., 1894, p. 172.

† *Archiv. f. Gynäk.*, Bd. ii., p. 440.

miliary in size and appearance, while there were about three quarts of blood-stained ascetic fluid encysted in the lower abdomen and pelvis. These tumours often attain to enormous dimensions, and their existence is usually accompanied by ascitic fluid, which is often stained with blood.

Prof. Leopold* considers that malignancy, as a character of tumours of the ovary, is far more common than is generally supposed. Among 600 ovariectomies in Schroeder's Clinic, no fewer than 100 are said to have shown signs of malignancy; and only 19.5 per cent. of the cases operated upon remained free from disease for more than a year. Olshausen in 293 cases found malignant disease 21 times. Many of these cases were no doubt malignant disease grafted upon cystic ovarian growths. Leopold found that in 110 completed ovariectomies, 20 (18 per cent.) had malignant growths. If to these are added six cases where removal was not completed, on account of implication of neighbouring structures, we have 116 operations for removal of ovarian tumours, in which 26 were found malignant—a proportion of 22.4 per cent., greater even than Schroeder's. Of the cases where the tumour was removed, 20 per cent. made complete recoveries.

Butlin† has collected from the writings of Cohn, Olshausen, Billroth, and Thornton, 78 cases of operation for malignant diseases of the ovaries of various kinds. Cohn's collection of cases (from Schroeder's Clinic), when weeded out, gave 55, of which 13 died; Olshausen, 13 cases, with 3 deaths; Thornton, 10 cases, with 3 deaths; Billroth, 21 cases, with 14 deaths. The general mortality was thus 33 per cent. And the after-results were not very encouraging, for only 5 out of 47 patients whose cases could be followed were alive and well three years after operation.

The results of these operations, when carefully worked out, are not, I suspect, so favourable as they are generally supposed to be. In the first edition of this work I quoted Cohn's statistics‡ in support of his statement that the number of permanent cures

* *Zeitschr. f. Geb. und Gyn.*, 1885, p. 14.

† Butlin, *Operative Surg. of Malig. Disease*, London, 1887, p. 346.

‡ *Deutsche Med. Woch.*, Jan. 4th, 1887.

would be found about equal to the number of deaths after operation. This was clearly too sanguine an expectation. Still, a certain proportion do, apparently, recover permanently; and it is reasonable to believe that this proportion would be increased if operations were done at the earliest possible period after diagnosis. And of those cases in which recurrence takes place, the subsequent course will usually be less painful than in cases not interfered with. As a matter of fact, however, malignancy is rarely diagnosed till after operation; the fact that so many ovarian tumours are malignant is another and a very strong argument in favour of early operation for all ovarian tumours.

Diagnosis.—Solid tumours of the ovary cannot be diagnosed from each other, and with great difficulty from similar growths arising from the uterus. In the case of cystic sarcoma, the diagnosis from polycystic glandular tumour and from soft nodular uterine myoma is practically impossible. Mobility and ascites are perhaps the most important single features pointing to solid ovarian tumour. The rapid accumulation of ascites around a solid movable tumour that has its deep attachment in the pelvis points to malignant disease of the ovary. A round extra-mural myoma may present clinical features identical with those of non-malignant solid tumours of the ovary. It is possible to confound these growths with pregnancy; and special care may be necessary when vascular bruits are heard in the tumour. In a majority of cases the diagnosis is not completed till the abdomen has been opened.

Operation.—The only peculiarities of the operation for solid growths are, the length of the incision which it is necessary to make, and the treatment of the pedicle. In average cases the incision will require to be prolonged above the umbilicus. When the tumour is fully exposed, it is lifted out by means of a handled screw placed in its substance. Removal is helped by lateral movements of the tumour; and the force of suction, which is often considerable, may be overcome by permitting air to enter the cavity with fingers or hand carried

round the growth. As soon as the growth is delivered, large sponges are placed in the cavity to prevent extrusion of the bowels; it may even be expedient to insert a few sutures at the top of the wound before doing anything else.

The pedicle in these cases is often thick, fleshy, and vascular. The Fallopian tube does not often form part of it; it is composed simply of mesovarium. The vessels are usually thin-walled and very large, so that they are liable to be injured by transfixion even with blunt instruments. Here, if anywhere, a second ligature below the double perforating ligature may be applied with advantage. The operation is completed and the case managed on the same principles as an ordinary ovariectomy.

The removal of sarcomatous cystic growths requires no special description. The pedicle is usually very thick, and peculiarly inelastic.

Papillomatous Tumours of the Ovary.

Papillary growths may be found in the interior of an ovarian cyst. They are quite common in cysts of the paroöphoron. Growing on the free surface of the ovary, papillomata are very rare. The origin of such growths, one of the most interesting questions in pathology, cannot here be discussed. It is dealt with in a masterly and exhaustive monograph by I. Whitridge Williams in the Johns Hopkins Hospital reports.*

From the clinical standpoint, the variety of papilloma bearing cyst which opens up the broad ligaments is specially discussed (p. 229), and supported by some personal experience. Of superficial papilloma of the ovary I have almost no clinical experience; what is written is founded on Dr. Williams's report.†

The appearance of a superficial papilloma is characteristic and unmistakable. The projections, sessile, or pedunculated, or branching out into the "most complicated arborescent structures," are like nothing else and need no elaborate description. The ovary is probably completely enveloped; it may on section present very little departure from the normal. The colour of the clusters is usually pinkish; in the substance of the growth psammomata often develop, giving to touch a sensation of grittiness.

These, like other papillomata, have a "marked tendency toward the formation of secondary growths. The majority of secondary growths are produced by mere extension of the growth, by continuity of tissue or by implantation of small particles of the tumour on the peritoneum. In rare instances, true metastases may be formed."‡ It is further said that these papillomatous growths have a marked tendency to become really malignant. Whether this is really a secondary development of malignancy in a tumour originally not truly malignant, or whether the presence of papillomata on the surface of the ovary is a sequence or concomitance of malignancy already existing, it is impossible to say. The frequent concurrence of malignant disease of the

* *Rep. on Pathology*, ii., 1892. † *Loc. cit.*, p. 35. ‡ Williams. *Loc. cit.*, p. 45.

bladder and simple papillomata points rather to the possibility of papillomata arising from some irritative or other influence caused by the young malignant growth. In any case all papillomata must be regarded as clinically malignant, and they must be completely removed.

The operation requires no special description, being practically the same as that for removal of all solid tumours. Handling must not be rough, otherwise bleeding may be free. It may be of advantage to surround the whole with a sponge-cloth, both for protection of the growth from injury and of the peritoneum from infection.

Operations for Cystic Growths in the Broad Ligament, Parovarium and Paroöphoron.

SURGICAL ANATOMY OF THE BROAD LIGAMENTS.

The broad ligament on each side is composed of a double layer of peritoneum enclosing cellular tissue in which lie blood-vessels, nerves, lymphatics, and muscular fibres (Fig. 61). The internal attachment is to the side of the uterus from the cornu to the level of the internal os; the external attachment is to the side of the

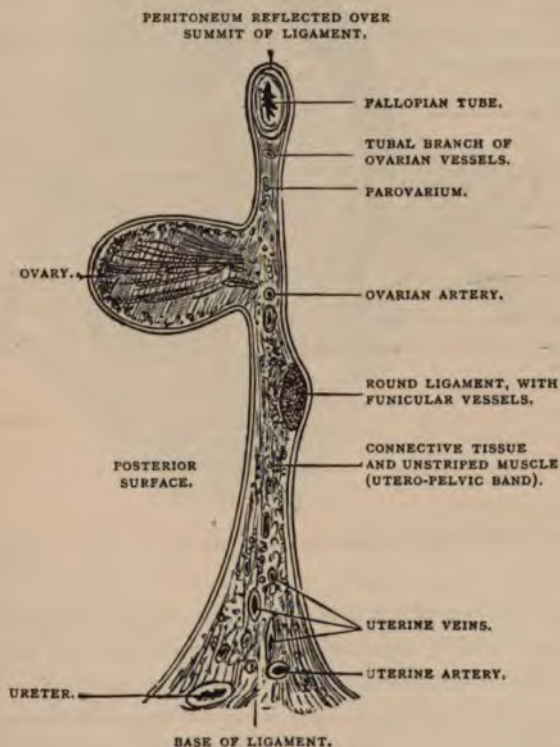


FIG. 61.

Vertical Section through the Broad Ligament. (ANDERSON.)

pelvis in a vertical line about midway between the obturator foramen and the great sciatic notch. Following its line of attachment from the cornu of the uterus to the cervix, the following structures are met with: at the cornu is the Fallopian tube; a little lower down and more to the front is the round ligament, and close to these is the spermatic artery; at the bottom is a space in which lies the uterine artery, usually dividing into several branches, with numerous veins, nerves, and lymphatics.

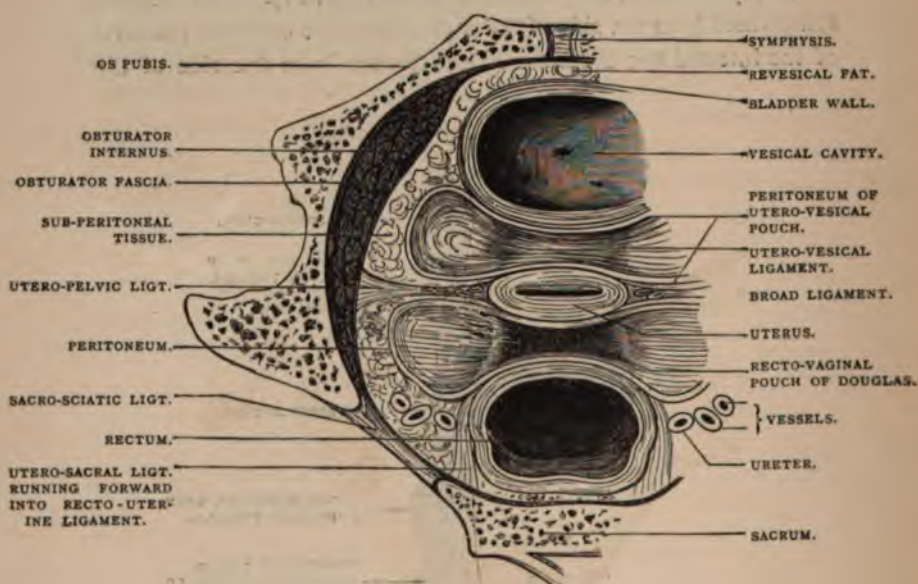


FIG. 62.

Section of the Pelvis showing the Ligaments of the Uterus. (ANDERSON.)

The convex base of the broad ligament lies upon the lax connective tissue which separates the vagina from the fascia which covers the levator ani muscle. In this tissue lies the large uterine artery, forming a loop with its concavity upwards as it courses between the internal iliac and the neck of the uterus. This vessel is likely to be pushed downwards by tumours growing in the broad ligaments; but if the growth is dragged upwards

during removal it is not out of the range of possible injury. The ureters, embedded in connective tissue, pass from behind forwards and inwards to the base of the bladder, crossing obliquely below the base of the broad ligament. They are also not beyond the risk of injury. In the pelvic attachment no vascular or other structures of importance are found. It must be remembered, however, that if the broad ligaments are pushed apart by an enclosed tumour, the posterior layer may be forced backwards so as to uncover, not only the ureter and the uterine artery, but the iliac vessels as well.

The free upper margin of the broad ligaments, looked at from above, is broader at its pelvic than at its uterine attachment. This is caused by the divergence of the round ligament, which curves forward to the inguinal opening, and which is so far removed from the broad ligament proper as to be described as

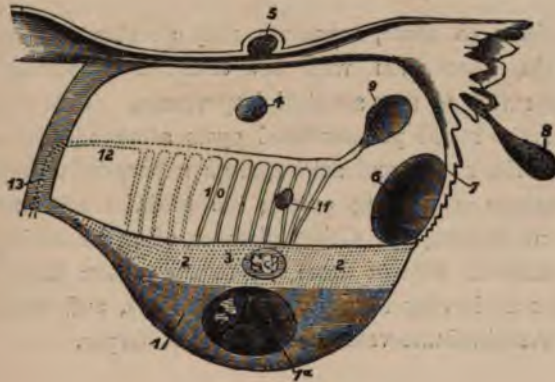


FIG. 63.

Diagram of the Structures in and adjacent to the Broad Ligament. (DORAN.)

1. Framework of the parenchyma of the ovary seat of 1a, simple or glandular multilocular cyst. 2. Tissue of hilum, with 3, papillomatous cyst. 4. Broad ligament cyst, independent of parovarium and Fallopian tube. 5. A similar cyst in broad ligament above the tube, but not connected with it. 6. A similar cyst developed close to 7, ovarian fimbria of tube. 8. The hydatid of Morgagni. 9. Cyst developed from horizontal tube of parovarium. Cysts 4, 5, 6, 8, and 9 are always lined internally with a simple layer of endothelium. 10. The parovarium; the dotted lines represent the inner portion, always more or less obsolete in the adult. 11. A small cyst developed from a vertical tube; cysts that have this origin, or that spring from the obsolete portion, have a lining of cubical or ciliated epithelium, and tend to develop papillomatous growths, as do cysts in 2, tissue of the hilum. 12. The duct of Gartner, often persistent in the adult as fibrous cord. 13. Track of that duct in the uterine wall; unobliterated portions are, according to Coblenz, the origin of papillomatous cysts in the uterus.

lying is a separate fold. The position of the ovary and tube in their folds of broad ligament have already been described. The veins of the broad ligaments form closely-set plexuses, which are of importance in relation to sub-peritoneal hæmatoma. The veins of the uterus, ovaries, and Fallopian tubes, after being gathered together in the pampiniform plexus, finally coalesce in the internal spermatic vein which follows the course of the spermatic artery.

The structures in and adjacent to the broad ligaments which are liable to be the starting points of disease are admirably depicted in the diagram here copied from Doran's work.

Operation may be indicated in any of the following conditions residing in the broad ligaments:

- (1) Simple cysts of the Broad Ligament. Parovarian cysts.
- (2) Papillomatous cysts of the Broad Ligament and hilum of the Ovary.

In addition to these, myomata may develop in the broad ligament in connection with its enclosed muscular tissue. These are rarely of any surgical importance. The same may be said of the small pedunculated cysts attached between the oviduct and the ovary, and arising from a parovarian tube, and of those others originating among the fimbriæ and known as Hydatids of Morgagni. Other diseases of great variety need not be described. One of these has recently been described by Mr. Taylor as having been removed by Tait, and which consisted of several minute vesicles like those of herpes.

Simple Cysts of the Broad Ligament.

These are frequently described as parovarian cysts. But it is now known that many simple cysts developed in the broad ligament do not originate in the tubes of the parovarium, but elsewhere between its layers. The profoundly interesting questions, from a developmental as well as a pathological point of view, which surround the origin of these cysts cannot here be discussed. Suffice it to say that the cyst arising outside of the parovarium is of the simplest possible nature, containing clear fluid in a translucent wall, and not developing adventitious new growths in its interior. According to Doran, it is lined with flat or low columnar epithelium. Cysts arising from the tubes of the parovarium—though they are, in the majority of instances, of the simple character indicated above—are further peculiar in showing a tendency to develop papillomatous outgrowths in their interior. If of small size, their lining may be of ciliated epithelium. According to Doran, "Histologically and pathologically, they are identical with the papillary cysts . . . that appear in the tissue of the hilum of the ovary where relics of the Wolffian body exist, and do not tend to invade the stroma of the parenchyma, but rapidly grow into the broad ligament, forcing apart its layers." *

The leading surgical peculiarity in these growths is, that they are unilocular. No true ovarian cystoma is unilocular. As a rule, they grow away from the broad ligament, pushing aside the ovary and the tube, and occasionally they exhibit a well-marked pedicle. Sometimes, however, they grow downwards, widely separating the layers of the broad ligament, and stretching out the tube and the ovary over their walls. They contain nearly always a clear limpid fluid with but little albumen. Sometimes, however, it is thick or semi-purulent, from inflammation; or dark, from intermixture with blood. Adhesions are rare. Tait describes an occasional great thickening of the cyst-wall consisting

* *Tum. of Ovaries*, &c., Lond., 1884, p. 49.

of fusiform muscular cells. Rupture is not infrequent; the results are not often serious.

Diagnosis.—A parovarian cyst is diagnosed from other cystic growths having similar attachments by the laxity of its walls, and the free and rapid wave of fluctuation which is given on palpation. It is perfectly round and globular, forming, if of moderate size, an evenly symmetrical tumour in the lower abdomen. Its growth is painless and unattended by symptoms of disturbance of the sexual organs. It is almost free from the dangers and complications which are sometimes found in connection with ovarian cystoma, and never produces the cachexia which so often accompanies that disease.

The diagnosis from such conditions as ascites and renal cystic developments is the same as the diagnosis of ovarian cystoma from these conditions. These being negatived, the separation is then simply from ovarian growths. Fibro-cystic disease of the uterus is a possible source of confusion.

THE OPERATION.

Tapping.—There is no doubt that tapping may permanently cure a simple cyst of the broad ligament. More than one surgeon of repute, and particularly Keith of Edinburgh, employs tapping as routine treatment in these cases. The cyst, being emptied, may not refill, and the patient is cured by the simplest possible treatment.

But objections may be urged to this simple proceeding. It is not always successful: some cysts refill. Bantock had a case which was tapped seven times. Tapping, even in the most skilful hands, may cause suppuration in a cyst. But the most weighty objection is the fact that papillomatous growths occasionally develop inside these cysts, and tapping then provides an avenue for infection of the peritoneum, a result which is inevitably fatal.

As a counterpoise to these objections, there exists the important fact that removal of these growths is peculiarly free from danger. If, in exceptional circumstances, we may feel

justified in giving the patient her chance of cure by tapping, I believe that the best routine treatment in these cases is removal.

Removal.—In most cases of simple cyst of the broad ligament removal is a very simple proceeding. The parietal incision need not be more than an inch and a half or two inches in length. The cyst-wall is very thin and easily torn, and fluid is very liable to escape by the side of the trocar. If no special appliance is used to avoid this, the simplest plan is probably to lay aside the trocar, catch the edges of the opening in the cyst-wall with forceps, pull them out of the wound, and let the fluid run over the macintosh into the vessel provided. The tumour usually is delivered without any trouble whatever. The pedicle is not often long, but it is rarely difficult to deal with. Vessels are neither abundant nor large, and the tissues are but slightly hypertrophied. Though there may be no very strong objection to leaving a portion of the cyst-wall behind, the ligature should always be carried below the limits of the growth. The ovary and tube may frequently be left behind; but unless this can easily be done, it is best not to complicate the operation in the slightest degree by seeking to separate them. Besides, any traumatism applied to the appendages is likely to beget trouble in future by the formation of adhesions.

In those somewhat rare cases where the cyst grows between the layers of the broad ligament, removal may be attended with considerable difficulty. Here there is no pedicle, and the base of the cyst lies deep in the pelvis. The growth must be dissected out from between the layers of the ligament in the manner already described for encapsuled ovarian growths. It is usually best to begin from the side next to the uterus. The flaccid cyst-wall is pulled out of the wound, which will have been enlarged as far as necessary, the peritoneal investment is teased open and the wall of the cyst is exposed. The finger, pushed into the cellular tissue, separates the cyst from the ligament by stretching rather than by tearing. The larger bundles of cellular tissue containing vessels are caught in catch-forceps and divided by scissors; and this process is repeated, step by

step, till the cyst is completely enucleated from its bed. As a rule there is but little hæmorrhage. In the deeper and outer portions, special care must be taken that the ureter or the uterine artery, or any other branch of the iliac vessels, is not injured. The two flaps representing the layers of the broad ligament may, according as seems best at the time, be either left untouched or united by suturing with or without removal of portions of them. In a case of this sort, it will be wise to insert a drainage tube.

Papillomatous Cysts of the Broad Ligament.

In a practical as well as in a pathological treatise these well deserve separate consideration. They are not common; but, from the peculiar and difficult nature of the operation necessary for their removal, they merit close attention.

The origin of these growths is not yet finally settled. The painstaking and able investigations of Doran leave little doubt that a frequent and favourite starting point is in the hilum of the ovary. It is well known that papilloma may develop in parovarian or other cysts of the broad ligament; it is certain that growths arising from the hilum are peculiarly liable to develop abundant papillomatous material. Papillary cysts may appear in connection with the ovary, and may overgrow the broad ligaments and the uterus; but here they exist almost entirely as accidental, and not as ordinary or essential, concomitants.

As a matter of practical surgery their remote origin is of little moment. What concerns us most is the fact that such growths always burrow between the layers of the broad ligament, and there develop peculiarities which may be made use of for purposes of diagnosis, and which make these growths among the most difficult to remove in abdominal surgery.

In the early stages the diagnosis from ovarian cystic disease is uncertain or impossible. I recently removed from a patient, in the Bristol Infirmary, a beautiful specimen of this disease about the size of a turkey's egg; here, accurate diagnosis was impossible. The clinical features of a well-developed papillomatous cyst are fairly distinctive: I have diagnosed three of the last four operations done; have erroneously diagnosed ovarian tumour in the first four. The clinical features drawn from these first four operations I have elsewhere* described at some length; they may be here abstracted as follows:

1. In their growth, papillomatous cysts of the broad ligament are not symmetrical. Growing as they do in the broad

* *Annals of Surgery*, 1885, vol. ii., p. 439.

ligament, and having no pedicle to permit their escape from the pelvis, they are fixed down on one side, and cannot, even when large, rise to the position of least pressure in the middle of the abdomen. Minor cysts bulge out where they can find room in the pelvis or on the side not occupied by the main cyst; but their aggregate bulk and arrangement are not such as to produce a balancing symmetry. Ovarian cystomata are not so persistently one-sided or so irregular in shape as these, and they are not so deeply nor so firmly attached in the pelvis.

2. In these cases there is usually found, in addition to the large papillary cyst, several small thin-walled cysts packed round the uterus and crossing to the opposite side of the abdomen. It is not a development of a multilocular growth, one large cyst divided by septa into several, but rather of several separate cysts sessile on a common base. These secondary growths are usually very thin-walled, and fluctuate freely. They can be felt through the vagina in Douglas's pouch, and through the abdominal walls, frequently overlapped by bowel on the side opposite to the main cyst.

3. Papillomatous cysts of the broad ligament are but slightly movable. In the pelvis, through the vagina, this sense of immobility is peculiarly striking. The growths are doubly fixed, by the broad ligament in which they lie, and by the minor cysts packed in the pelvis which spring from them.

4. In most of these cases there is considerable enlargement and elevation of the uterus. That the uterus should be enlarged is readily understood, from its close physical and vascular connection with the very vascular growth. That it should be elevated is a necessary consequence of the direction of the growth of the tumour which is attached to it. This enlargement is in excess of what we find in adherent ovarian cystoma. The uterus usually lies in a deep sulcus between the major cyst and the minor cysts, giving an appearance of two growths; but sometimes it lies behind the growths, being overlapped by them. The bladder may be dragged upwards with the uterus.

5. As a corollary from the preceding propositions, we might

infer physical interference with the processes of defæcation and micturition. The enlarging growth being fixed in the pelvis, of necessity compresses the hollow viscera. In one case upon which I successfully operated the frequency of micturition almost amounted to incontinence; in this case, the difficulties of defæcation more than once amounted to positive obstruction. A curious feature in the case of this patient was that she could defæcate only when standing upright, probably because the sitting posture forced the growth down into the pelvis. In two other cases* troubles on micturition were considerable, but not urgent.

6. Papillomatous cysts are peculiarly liable to undergo rupture. This is an indication to operate, because of the danger arising from infection of the peritoneum. In one of my cases there was an extraordinary and perhaps unique history of rupture on, at least, twelve occasions. Most of these ruptures were, however, in my belief, confined to the minor cysts; but there is no doubt that rupture of the papillary cysts frequently takes place. It is, however, more a leakage through a small opening than a gush through a large one, and the opening is usually blocked by the papillary growths floating into it.

THE OPERATION.

The first element of danger in these cases refers to the possible elevation of the bladder, and the risk which it thereby incurs of being wounded in making the parietal incision. The incision ought therefore to be made higher up than usual, and it should be short. If the bladder is out of the reach of danger, the incision may be prolonged downwards to the requisite distance.

The second peculiarity refers to the mode of tapping the cyst. It will not always be possible to bring the cyst-wall to the surface; and, as peritoneal infection might be caused by the escape of cyst-contents into the peritoneum, extraordinary precautions must be taken to collect all fluids which may escape

* *Loc. cit.*

by the side of the trocar. And when no more fluid flows, the opening must be perfectly closed by forceps or clamp. It is not wise to break down and remove papillomatous material by the hand; the bleeding is so free, and the risks from escape of the growth are so serious, that it is better to enlarge the incision and deliver the tumour bodily.

Tapping of the secondary cysts is best done by aspirator. They can rarely be brought to the surface, and they are very thin-walled and peculiarly liable to be ruptured in manipulation. A large trocar attached to an aspirating bottle is inserted, sponges are placed round the site of puncture, and the fluid is drawn off from the various cysts in succession.

When the cysts are emptied the process of separation begins. It may be impossible to tell where uterus ends and tumour begins, so closely are they sometimes incorporated. It may therefore be wise to depute an assistant to pass and manipulate the uterine sound as a guide. The same may be necessary in the case of the bladder, especially if it is empty, and its walls are collapsed and flaccid. Here the disadvantage of an empty bladder is conspicuous. It may even facilitate operation to inject a few ounces of fluid into the bladder, so as to accurately show its limits. The peritoneum covering both uterus and bladder may be thickened, movable, and very similar in appearance to that covering the growth.

It is impossible to give useful instructions as to where the process of separation is to begin for any case. This depends upon the position of the growth and the nature of its attachments. If possible, I would recommend that a beginning be made near the uterus, so as to cut off as much of the blood-supply as possible early in the process of separation. A small incision is made by knife or scissors, the finger is pushed through this and rapidly separates as much of the growth as possible. This separated portion is either surrounded by ligature or caught in large pressure forceps, and the tissue cut through beyond. If the operation can be continued and completed by repetitions of this process, it will be much simplified. But we must expect to have to carry out a much more com-

plicated process of dissection, in which scissors, knife, forceps, ligature, and even actual cautery, are in constant requisition. I know of nothing which more fully tries the patience and skill of the surgeon than such a dissection. At a distance probably of several inches from the surface, not easily seen and with difficulty handled, each area of adhesion has to be dealt with promptly and decisively. If the adhesion can be surrounded by forceps or ligature before being divided, enucleation is simplified. But often the adhesion must be separated by fingers alone, and the raw surface bleeds freely. Forceps must be placed on the bleeding points when they are visible: for a general oozing sponge-packing or the cautery must be used. In separating adhesions from the bladder, special care must be taken to avoid tearing its walls; and if points bleed and forceps are placed on them, we must be particularly careful to see that the strong locking instrument does not grasp a piece of bladder-wall and so cause a risk of sloughing. If the adhesions to the posterior surface of the uterus are particularly strong, it may facilitate matters to prolong the incision upwards for such a distance as to permit the whole to be turned out over the pubes with the uterus, and then proceed with the parts in sight. In one such case I had tumour, enlarged uterus, and greatly distended bladder lying, apparently as one homogeneous mass, on the macintosh covering pubes and thighs. If this can be done, it greatly simplifies operation.

We must expect to find intestine adherent to the surface of the growth and in the sulci between the smaller cysts; and here special delicacy in separating must be observed. The ureter too, and the uterine artery with branches of the internal iliac, may be within reach of danger, and they must be looked for in manipulations near the lower and outer attachments of the broad ligaments.

The toilet of the peritoneum must be carried out with particular scrupulousness. Tait's plan of washing out the cavity may here be used with special advantage. The insertion of a drainage tube will almost certainly be called for.

Removal of the Uterine Appendages.

Nomenclature.

History.

Aim of Operation.

Conditions indicating Operation :

Disease in the Ovaries.

Disease in the Fallopian Tubes.

Disease in the Uterus.

In Neuroses.

The Operation :

Appendages normal.

Appendages inflamed.

For Uterine Myoma.

For Ovarian Hernia.

Progress after Operation.

Remote Effects of the Operation.

Conservative Operations on the Ovaries and Tubes.

Nomenclature.—The want of a good name for this operation is very inconvenient. *At first, when its object was supposed to be limited to the production of an artificial menopause, the operation was known as "normal-ovariotomy." Battey, who introduced the name, was among the first to recognise its unsuitability. As a matter of principle, the operation was by no means restricted to ovaries that were normal; and, as a matter of practice, it was found that most of the ovaries removed were actually diseased. The term "Battey's operation," while suitable within the limits which Battey laid down for it, does not include the more extended modern proceedings. "Oöphorectomy" had already been used by Peaslee and others as a synonym for ovariotomy before it was sought to limit it to removal of small ovaries; and as oviducts are now, in most cases, removed as well as ovaries, the term is in a double sense objectionable. In connection specially with disease of the

Fallopian tubes, Tait's name became associated with removal of the uterine appendages; and when, in harmony with certain beliefs which he holds as to the functions of the oviducts, he practised removal of the tubes as well as of the ovaries where others had been content with removal of the ovaries alone, the proceeding of "Removal of the Uterine Appendages" came to be known as Tait's operation. Men performed Tait's operation with Battey's motives; hence a confusion which has been rendered more confounded by more than one surgeon calling it the "Battey-Tait operation." The German terms, "spaying" and "castration," are objectionable on the grounds both of good taste and of exact naming. In many of the operations performed the effect of castration, as usually understood, is an undesirable accident rather than a definite aim. "Salpingectomy" for removal of the tubes, and "salpingo-oöphorectomy" for removal of the appendages, are fairly exact but decidedly cumbersome. "Prosthektomy" is equally applicable to caudal and to uterine appendages. A friend has suggested to me the word "thelytectomy" (Θηλύτης = feminine principle); but this, perhaps, is too suggestive of castration. Under any of these names, it is impossible to give a complete account of any recognised surgical operation; therefore, in place of a better, the vague but comprehensive title, "Removal of the Uterine Appendages," is adopted. Even to this name the objection may justly be raised, that the uterus is an appendage to the ovaries, rather than the ovaries to the uterus. From a surgical stand-point, however, the objection has less weight than from a physiological. Skene of Brooklyn* seeks to get over the difficulty by the use of the term "tubo-ovariotomy." But ovariectomy for tumour is also "tubo-ovariotomy" in the sense which he suggests; and, according to ordinary meanings of words, his term might easily be interpreted as meaning something very different from what was intended.

History.—As a barbarous custom, the castration of women dates from a very remote antiquity. In the case of female

* *Diseases of Women*, 2nd ed., 1892, p. 509.

domestic animals, such as cows, camels, sows, bitches, mares, and ewes, we have abundant evidence in the writings of Aristotle, Pliny, Galen, Suidas, and others, that castration was very generally practised. The practice is said to have been extended to women at the instigation of certain kings of Lydia. According to Xanthus, a Lydian historian who wrote in the sixth century before Christ, the Lydian king Andramyte first introduced female eunuchs into the service of his palace. Gyges, another king of Lydia, is said to have caused the removal of ovaries from women with a view to prolonging their charms—"quo illis semper ætate florentibus uteretur." Various authors have thrown doubt on the reality of this proceeding, saying that the so-called castration was either the removal of the uterus (which is most improbable), or ablation of the nymphæ or the clitoris, or even (which seems an unwarrantable postulate) padlocking or "infibulation," a proceeding analogous to that which Celsus describes as having been carried out on boys. If the Lydians really castrated animals for domestic purposes,—and of this there can scarcely be a doubt,—it is quite within the bounds of possibility that they castrated women also. It is certainly unlikely that with the Lydians any other form of mutilation than removal of the ovaries should be considered as constituting castration.*

Even in times comparatively modern it is stated that the practice has been in vogue in Central Asia. A medical missionary, Dr. Roberts, is said to have met, in Bombay, Hedgeras—attendants in harems—who were spayed.† He remarks that they did not menstruate, and that they had no sexual desire.

The story of the Hungarian sow-gelder who, in a fit of parental anger, castrated his unchaste daughter, is supported by testimony

* Many classical writers of the Middle Ages refer to the practice. For more detailed accounts see—

Dujardin, *Hist. de la Chirurgie*. Paris, 1774.

Mahon, *Médecine Légale et Police Médicale*. Paris, 1801.

Much interesting information will be found in the second volume of Pierre Dufour's laborious work, *Histoire de la prostitution chez tous les peuples du monde*; and a moderately full summary, with numerous references, is given by Boinet in the article, "Ovariectomie," in the *Dict. Encycl. des Sc. Méd.*

† "Hedgeras de l'Asie Centrale," *Journal l'Experience*. 1843.

of real weight.* Schurigius speaks of two similar cases; and other cases, with less weight of authority, have been recorded.

These ancient practices were not, however, therapeutic measures. Among the earliest operations performed with a beneficent purpose is that related by Franck de Franckenau, in which an ovary, prolapsed through a wound accidentally made over the pubes, was successfully removed. Percival Pott's well-known case of removal of herniated ovaries occurred in 1756. Thereafter the history of the operation is merged in that of modern ovariectomy for tumours.

In 1823 James Blundell, of Guy's Hospital, a man far in advance of his times, in a paper read before the Medico-Chirurgical Society of London, suggested removal of healthy ovaries in cases of severe dysmenorrhœa, or metrorrhagia from inverted uterus. His advocacy of removal of the whole uterus in place of ordinary Cæsarean section, and the scientific manner in which he sought to sustain his arguments by experiments on rabbits, have scarcely received the attention which they deserve. As more germane to the subject in hand, special reference must be made to his proposed method for producing sterility in cases of malformed pelvis, where Cæsarean section had been called for. His words are as follows: "I would advise an incision of an inch in length in the linea alba above the symphysis pubis; I would advise, further, that the Fallopian tube on either side should be drawn up to this aperture; and, lastly, I should advise that a portion of the tube should be removed, an operation easily performed, when the woman would for ever after be sterile."†

Dr. Robert Battey, of Rome, Georgia, generally gets the credit for having been the originator of the operation as it stands in modern surgery. In 1865 he "conceived the idea of producing an artificial menopause for the remedy of disease;" but he did not publish his ideas till 1872. In February, 1872, Lawson Tait removed with complete success an ovary the size of a pigeon's egg, which contained a chronic abscess. This he claims‡ as being "the first record in the history of surgery of

* See particularly Wierus, *Opera*, lib. iv., cap. xx.

† *Principles and Practice of Obstetrics*, Ed. by Th. Castle, London, 1834, p. 580.

‡ *Dis. of Ovaries*, 4th Ed., p. 324.

the removal of a small ovary on account of pain." Encouraged by this success, on August 1st, 1872, he successfully removed both ovaries for the purpose of arresting intractable hæmorrhage.* A few days before the date of Tait's second operation, Hegar operated on his first case with fatal result. On August 17th, 1872, Battey performed his first operation, which was successful, and in the following month he published it.†

In discussing the history of the operation, it may be objected that Tait's first operation was not performed with the aim which Battey proposed. The ovary was felt enlarged in Douglas's pouch; and as only one ovary was removed, the operation was not intended to "produce an artificial menopause." There is no suggestion that the proceeding was the fruit of any preconceived theory; it was a local operation for a local disease. But who shall say of the original work of a practical man that it was not preceded by theory? Tait's second case was undoubtedly a physiological and pathological experiment; in favour of its probable success only theoretical reasons could be advanced. Hegar, too, must have independently thought out the operation; it has certainly been his fortune materially to influence its progress. To claim a priority measured by days or months is to be exact at the expense of liberality, or even of justice; the time was ripe for the operation, and three independent workers—Battey, Tait, and Hegar—may be permitted to share the honour of introducing it.

As might be expected, the work of these three men has tended to run in different directions. Battey's name has continued to be associated chiefly with the operation as performed for what may loosely be called "neuroses." Tait's name is mainly connected with inflammatory diseases of the tubes, and his influence has been strongly felt in the substitution of operation for actual disease as against vague nerve-symptoms. Hegar, again, is best known in connection with the operation for uterine myoma. Trenholme, in January, 1876, claims to have

* By some mistake Battey records this case as being fatal. *Trans. Internat. Med. Congress*, Lond., 1881, vol. iv., p. 287.

† *Atlanta Med. and Surg. Journal*, Sept., 1872, p. 321.

been actually the first to remove ovaries for bleeding myoma; but his influence has not been so great as that of others.

The practice of numerous followers in the footsteps of these pioneers has widened the range of the operation, at the same time that it has narrowed down its indications. Greater exactitude in diagnosis, and increasing knowledge in pathology, have largely replaced functional neuroses by palpable disease. Except for uterine myoma, the field for spaying, properly so-called, is being greatly narrowed; on the other hand, the field for the removal of incurably diseased organs is being immensely widened.

The Aim of the Operation.—The purpose of the operation, as enunciated by Battey, was "to determine the change of life for any grave disease which is incurable without it, and which is curable with it." Though this definition may have held good for his own operation in its first conception, it is obviously imperfect as regards the operation in its modern development. In fact, a complete change of front would probably cover more cases; it would certainly be more correct to say that removal of the uterine appendages is performed for local disease in the ovaries or tubes, than that it is done "to determine the change of life." But the operation has more than one aim; the definition of its purpose cannot be gathered into one sentence. It has a threefold purpose: (1) to remove organs incurably diseased; (2) to check or modify the discharge of blood from the uterus; and (3) to completely abrogate the process of ovulation.

1. The removal of organs incurably diseased, and causing danger to life or serious disablement, is, undoubtedly the most justifiable aim of the operation. Under this head we have to deal with such conditions as abscess in the ovaries or tubes, Fallopian pregnancy, and strangulated ovarian hernia which cannot be reduced; these endanger life: also with the various cystic diseases of the tubes, the more chronic and subacute inflammations of the ovaries, and their displacements; these cause disablement in varying degrees.

2. It may be necessary to check bleeding from the uterus, either on account of its being excessive in amount, or because its discharge is attended with danger or great pain. Uterine myoma is the chief cause of metrorrhagia; incurable obstruction in the vagina or elsewhere to the menstrual flow causes both pain and danger; and certain malformations, malpositions, and diseases of the uterus may be attended with so much pain at menstrual periods as to render life a sort of recurrent martyrdom.

3. To unsex the woman—the aim sought when castration is spoken of—is the least definite and the least satisfactory purpose of the operation. The ill-defined class of so-called reflex neuroses is not here specially meant; all, or at least the great majority of, inflammatory diseases of the appendages are attended by “reflex neuroses.” Here we particularly refer to actual nerve diseases, such as mania or epilepsy, which we have reason to believe are either caused or kept up by the processes attendant on ovulation.

These theoretical “aims for operation” will be put into actual concrete and positive “indications” when the diseased conditions are specified and described. But with the purpose sought we must reckon the result achieved; and this result often oversteps the purpose. We may desire to put a stop only to that part of the sexual process which consists in the discharge of blood from the uterus, whereas the actual effect of operation is to strike at the root of the whole function of ovulation and destroy it. What exactly is the value of this *per contra* which we have to reckon with?

Here we have to deal with sentiment as well as with science. The question is dragged hither and thither between the practical enthusiasm of the operating surgeon and the destructive criticism of the arm-chair theorist. It is the pride and glory of abdominal surgery that it lives and thrives upon statistics; and it is, perhaps, true that some men ask us to estimate their capacity in general by their experience in detail. This is a fault, but it is a fault in the right direction. And here the legal maxim, “*Ex abusu non arguitur in usum*,” holds true. The evils produced

by some men doing too much will never be counterbalanced by other men doing too little.

Practical men care little for fine-spun theories; they want to get their patients well. If objection is taken to the operation on the ground of the loss of sexual feeling, they say that this is a petty and contemptible thing to be weighed against prolonged suffering. If loss of the power of reproduction is the complaint, this is a weighty reason,—one in which those first interested must have the last word. Put to the patient herself, or to her husband, these objections—if the case is one in which operation ought ever to be contemplated—are usually promptly and summarily dismissed. And when the actual fact—that the womanly attributes are lost no more after the artificial than after the natural menopause—is borne in mind, the objections have still less weight. In most cases, child-bearing was either impossible or dangerous; here there is no loss: and, in many, dyspareunia is changed into eupareunia; here there is a gain. The general effects of the operation are nowhere better expressed than by Koeberlé, as translated by Barnes:* “The subjects may be regarded as women who have suddenly attained the menopause. The affective sentiments remain untouched. They are no longer under the dominion of an imperious erotic want; but they are not the less good, loving towards relatives and husband. The genital organs remain excitable; the character becomes gentler, less irascible; the breasts do not atrophy; the tone and voice are unaltered.” In one sentence, the change is one from active uxoriousness to staid, gentle matronliness. There is nothing very repulsive in this. Here, so far, the matter may rest. The definite results for the definite diseases will be indicated further on.

Considerations that ought to have at least as much weight as the ethical or sentimental ones just mentioned are, firstly, the danger of the operation itself, and, secondly, the not absolute certainty as to permanent cure among cases that recover. The average operator cannot count upon a mortality of less than 8 per cent.; and, as results go, he may expect a perfect cure in

* “On Hernia of the Ovary,” *Am. Journ. Obstet.*, January, 1883, p. 22.

no more than 90 per cent. of all the cases that recover from the operation. These are grave facts to be dealt with in an operation not always intended to save life. The patient may be suffering a prolonged martyrdom; but a surgical operation which does not bring cure is scarcely a respite, and death is a terrible penalty to pay for relief. On these grounds we ought to be assured, in the first place, that there is a clear case for operation; and, in the second place, that the full ratio of probability of favourable results belongs to the case under consideration.

CONDITIONS INDICATING OPERATION.

The disease—the extent of it and the symptoms which it produces—is the final criterion as to operative interference. It serves no good scientific purpose to describe a symptom as a cause of operation; it is unfortunate that so many operations are recorded as being for ovaralgia, dysmenorrhœa, and such like. The evil has not been diminished by the recent appearance of certain valuable papers in German periodicals, entitled “Castration for Neurosis.” In most of the cases described pain was the only neurosis, and in most of them also there was actual disease in the appendages. It is just as scientific to speak of excision of the hip for reflex pain in the knee, as of excision of the appendages for reflex pain in the back. Wherever it is possible the disease ought to be quoted as the cause for operation, and not the symptoms of it. In a small and diminishing class of cases a profound neurosis, mania or epilepsy, may, under very special restrictions, be quoted as an indication to operation. Yet even in these, with a curious frequency, disease of the organs is found at operation. For the rest, the disease will be spoken of as the indication for operation. Thus, instead of speaking of removal of the appendages for ovaralgia, dysmenorrhœa, or menorrhagia, we speak of the operation as being for ovaritis, pyosalpinx, or myoma. With this view the indications for operation may, in skeleton outline, be presented as follows:

A—THE APPENDAGES.

(1) *The Ovaries.*

- (a) Inflammation—acute, chronic, and suppurative (abscess).
- (b) Displacement (prolapse, hernia).
- (c) Cirrhotic and cystic ovaries.

(2) *The Fallopian Tubes.*

- (a) Inflammation—Salpingitis.
- (b) Pyosalpinx.
- (c) Hæmatosalpinx.
- (d) Hydrosalpinx.
- (e) Fallopian pregnancy.

B—THE UTERUS.

- (a) Uterine myoma.
- (b) Errors of development—absence or mal-development of uterus with menstrual molimen.
- (c). Incurable displacements with severe nerve-symptoms.
- (d) Insuperable obstruction to menstrual flow (may reside in vagina).
- (e) Chronic or recurrent inflammation of the uterus.

C—THE NERVOUS SYSTEM.

- (a) Mania; puerperal mania, menstro-mania, nymphomania, &c.
- (b) Epilepsy; hystero-epilepsy, convulsions, cramps, dancing fits, &c.
- (c) Hysteria.

It need scarcely be pointed out that the mere existence of any of these abnormal conditions is (with possible exceptions in the case of three or four of them) no indication for operation. The essential concomitants of these diseases must be of a grave nature—there must be danger to life or serious impairment of health—before operation is contemplated. With this preliminary and comprehensive proviso we may proceed to consider the indications in detail.

DISEASE IN THE OVARIES.

Ovaritis, Oöphoritis, Inflammation of the Ovaries.—The chronic form of ovaritis arising from excessive functional activity, which is found in prostitutes, rarely calls for operation. So also those temporary acute congestions, as obscure in origin as they are in pathology, require no notice. The majority of cases requiring operation have their origin in gonorrhœa. Septic matter may be carried along the tubes to the ovaries by puerperal inflammation in the uterus; and there is no doubt that a septic catarrh of the endometrium set up by traumatism, as from the sound or tangle tent, may also be a cause. The exanthematic fevers and acute rheumatism sometimes beget a form of ovaritis which is attended with troublesome symptoms. Cases following septic inflammations at childbirth always pursue a rapid course and eventuate in abscess, which may be rapidly or even suddenly fatal, or may pursue a more chronic course, bursting into one or other of the neighbouring hollow organs. Following gonorrhœa, or simple traumatism, or any of the exanthemata, ovaritis is liable to become very chronic, and here indications to operate are most frequent and most legitimate.

In such cases the local signs may be marked enough, but urgency is usually bespoken by the reflex or the functional symptoms. The ovary is exquisitely tender to all mechanical disturbance, when the patient stands or moves quickly, and it drags on its ligaments or is jerked; and when it is pressed upon by the fingers through vagina or parietes. Engorgement at the menstrual period aggravates the pain. In the intervals also it causes pain, local on various provocations, and outlying and reflex in the groins, in the back, down the thigh, in the hypochondrium, and elsewhere. Almost every known form of functional sexual derangement may be associated with ovaritis—dysmenorrhœa, menorrhagia, amenorrhœa.

Some weight must be given to the physical signs. An inflamed ovary has a tendency to fall downwards into Douglas's pouch and to become fixed there. Here it may be felt exquisitely tender, and sometimes causing a peculiar feeling of nausea on

being pressed upon. In this situation it may readily be mistaken for the fundus of a retroverted uterus. A skilled diagnostician will at once recognise the shape and consistency of the ovary; he may even palpate its ligaments, and, with a high degree of probability, diagnose the presence of fluid or cysts in its substance. In thin patients the unprolapsed ovary may be palpated between the fingers in the vagina and on the parietes.

In a case diagnosed as chronic ovaritis, from whatever cause arising, if remedial treatment has had a full and fair trial, and if the patient's health is being undermined by the constant pain and other accompaniments, operation may be recommended. If abscess exists, life is endangered and operation is imperative. In the former case the indication follows on the gravity of the symptoms; in the latter, the indication is positive and absolute on the existence of the disease.

Displacements of the Ovary—Hernia: Prolapse.—Among the first, if not actually the first, oöphorectomies for a beneficent purpose were one for *hernia of the ovaries* through a wound, and one for hernia into the inguinal canal. Hernia in itself is not an indication for operation. The herniated organs must be irreducible or the source of great pain, or the seat of some form of degenerative or inflammatory disease, before operation is contemplated. A traumatic hernia following strain or parturition is not so likely to be attended with troublesome symptoms as a congenital hernia. The latter variety is twice as frequent as the former, and is usually not of so simple a nature. Congenital hernia always contains tube as well as ovary; not infrequently it is associated with uterus bicornis, and one horn of the uterus occasionally follows the appendages into the hernial sack; also under-developed uterus, with its accompanying symptoms of aggravated molimina, may complicate the condition. In at least six cases complete absence of the uterus has been noted as accompanying inguinal ovarian hernia.

The diagnosis is not often difficult. The characteristic size and shape, the sensations upon pressure, the increase in size at the menstrual periods, and the frequent association with mal-

formations of the uterus, form a combination which can scarcely be imitated by any other condition. A sign of importance, where it can be elicited, is an associated movement with lateral displacement of the uterus.

The tumour increases in size at the periods, and becomes more tender. Then the symptoms may mimic those of strangulated hernia. Actual strangulation may take place, and then operation is imperative. So also if extra-uterine pregnancy takes place in the sac, an occurrence of curious frequency, operation is indicated. And any degenerative or novel development in its tissue, cystic or glandular, demands operation. Otherwise the indications rest upon its resistance to palliative measures, its irreducibility, and the urgency of the symptoms which it produces.

It has to be noted here, and will further be considered under "Conservative Operations on the Ovaries and Tubes," that a herniated ovary, even if strangulated, need not always be removed. It may be returned; and if, with this, a radical cure is performed, a more perfect operation may be performed than removal.

Prolapse of the ovaries is a condition by no means always demanding surgical interference; it is often accidentally discovered during examination for other purposes. Symptoms of urgency are produced only when they become inflamed or are bound down by adhesions. The existence of adhesions between mobile abdominal organs as a cause of pain, or other abnormal symptoms which may be of grave import, has probably not received the attention which it deserves; in the case of the ovary, from the nature of the organ, it is certain that this condition is peculiarly liable to breed trouble. Adhesions in Douglas's pouch are most common, but they may be attached to almost any part of the intestinal or pelvic peritoneum. I have successfully operated upon a case where the left ovary was closely adherent on one side to the sigmoid flexure, and on the other to the tip of the vermiform appendix. The ovary being dragged upon between those restless organs, it was not surprising that acute symptoms of ovarian irritation were produced. Sometimes

mere prolapse started by congestion may be continued by a sort of strangulation of the blood supply; in such cases operation may be required, though no adhesions exist. Oöphorraphy, or fixation of the ovary by a special proceeding, has been devised to meet this condition; the value of it has yet to be decided. The left ovary is more frequently prolapsed than the right, probably because it is more liable to become congested on account of the left ovarian vein having no valve. Conservative operations on adherent ovaries have been attended with considerable success. This will further be referred to.

Cystic and Cirrhotic Ovaries.—Though it is probable that small cystic ovaries have their origin in chronic inflammation, and it is almost certain that cirrhosis or fibroid thickening of the ovaries claims this cause, yet in actual practice the condition is not found to be inflammatory. In the cystic ovary the disease is not that of ordinary cystoma—a glandular new growth, but simply a distension of follicles in the thickened and contracted stroma. In true cirrhosis the gland tissue is replaced, in whole or in great part, by fibrous material; the surface is puckered and scarred, and the size of the organ is diminished. It would seem that one termination of the ovaritis found after the exanthemata, especially after scarlet fever, is in this cirrhotic atrophy with follicular distension. The pathology of this condition is still but ill understood.

It is a clinical fact that small cystic ovaries are often attended with profuse and uncontrollable menorrhagia. On the other hand, pure cirrhotic atrophy may be accompanied by amenorrhœa, though the menses may be excessively severe. In many all the varied and shifting symptoms of deranged sexual function are present in their most aggravated forms. And in such—partly, no doubt, because local disease cannot be physically made out—ovarian neuroses are abundantly called in to justify operation. Taking Schmalfuss's statistics of Hegar's operations as fairly representative, quite one-half of the so-called functional neuroses own such parenchymatous changes in the ovaries as causes.

These cases run a very prolonged course ; they are peculiarly resistant to palliative measures, and the reflex disturbances are liable to be marked and numerous. If the patient cannot put up with her troubles, and the menopause is not near, operation may be performed : it is the only cure.

DISEASES OF THE FALLOPIAN TUBES.

Half a century ago, diseases of the Fallopian tubes were well described by more than one writer ;* but so completely had all knowledge of them dropped out of mind, that when, a little while ago, a distinguished provincial surgeon published results of operations for such diseases, an equally distinguished metropolitan brother expressed a somewhat emphatic disbelief, not only in the operation, but in the diseases as well. It betokened an extraordinary, and almost discreditable, ignorance of the work of our predecessors that Tait found it necessary to send far and near specimens of these diseases, in order to establish a belief in their reality. It is well enough known now that diseases of the oviducts are a prolific cause of serious functional disturbances, and that they may even cause death. The difficulties are now not so much theoretical as practical : how to diagnose them, and how best to treat them ; when palliative measures may be persevered in, and when operation becomes necessary.

Clinically, it is impossible to separate simple salpingitis from hæmatosalpinx and pyosalpinx. The last two may, in fact, be considered as varieties of the first. When the septic inflammation reaches the fimbriæ, it binds them together and to the ovaries, sealing up the opening. The opening into the uterus is either closed or too small to permit exit to all the fluid ; thus we have catarrhal inflammation in a closed sac, the mucous lining of which bleeds every month. While the peritoneal covering exhibits the usual changes consequent on inflammations of

* In Dekker's *Exercitationes Practicæ*, published at Leyden in 1695, there is a description of a case of Fallopian distension, with a highly artistic drawing of the state of parts found after death.

serous surfaces, the cavity may contain blood or pus or a mixture of both. The amount of the blood or pus contained in the tube varies greatly. Sometimes it may be less than a drachm: collections of blood rarely exceed an ounce. I have removed a Fallopian abscess which contained more than a pint of putrid pus along with a considerable amount of gas.

Most cases of salpingitis are septic, the result of inflammation of the endometrium, gonorrhœal or puerperal. Some cases originate in leucorrhœa, and in such Wylie tells us he has, by squeezing the tubes, made the pus flow into the uterus and appear in the vagina. A few are caused by syphilis; some are tubercular. Sânger has found actinomycosis as a cause of suppuration.

Martin* of Berlin has made an elaborate study of tubal disease from a collection of 287 cases. The great majority (220) were married; 113 were barren; 61 had aborted once or oftener. The causes were, in 147 cases, acute or chronic endometritis; in 70, puerperal inflammations; in 55 gonorrhœa; in 3, syphilis; and in 10, tubercle. Tubal inflammations Martin divides into Salpingitis Catarrhalis, where there is infiltration into the mucous membrane; Salpingitis Interstitialis, where the muscular coat is involved; and Salpingitis Follicularis, where pouches are formed on the surface of the mucous membrane. The whole question of gonorrhœal inflammation in its bearing on tubal disease has been treated in a masterly and almost exhaustive manner by Sinclair of Manchester,† and to his papers I must refer my readers.

An inflamed and engorged or distended tube usually falls downwards into Douglas's pouch, and becomes more or less intimately adherent there. By the vagina it may be felt as a moderately soft, boggy, irregularly rounded tumour, not unlike the fundus of a retroverted uterus. It is exquisitely tender to the touch, causing dyspareunia, and cannot readily be pushed upwards. Attacks of pelvic pain, greatly increased at the periods, but aggravated at other times with or without provocation, accompany the complaint. Menstruation is fitful and irregular, usually increased

* *Zeitschr. f. Geburt.* XIII., ii. † *Med. Chron.*, Aug., Sept., Oct., 1887.

but sometimes diminished in flow. Each period, in hæmato-salpinx, adds to the danger as well as to the pain. Most cases occur in married women, and, according to Tait, "a very frequent feature in the history of the cases was found to be that they had one child, and after that were never free from pain till relieved by the operation."

In every case of true and persistent salpingitis operation is indicated. With judicious treatment and rest, mild cases may get well; but when the ends of the tubes are blocked, and they contain pus or blood, removal gives the only chance of relief. It must not be forgotten, as an indication to operate, that there is real danger to life in septic inflammations of the Fallopian tubes.

Hydrosalpinx is a milder affair, and may be attended with very few symptoms. In many cases it is simply a retention cyst in a functionally inert duct containing clear fluid; in others, epithelial *débris* or pus, sometimes mixed with blood, is found. The cause of the occlusion being usually inflammation extending from the uterus, both tubes are often found blocked. In a case on which I operated, one tube contained several ounces of clear fluid; the other contained a fluid so thick with flakes of cholesterine, that it looked like molten silver when poured from one vessel into another.

The diagnosis is physical. A sausage-shaped or tortuous cyst in the retro-uterine space, with symptoms of disturbed sexual functions, worst at the periods, and less severe than in acute salpingitis, suggest the disease.

As to operation, hydrosalpinx is said—I believe on insufficient grounds—sometimes to last a lifetime, producing no symptoms and causing no harm. In many cases the symptoms are so severe as to demand operation; in all operation is advisable. The disease will not improve; from accidental or other causes the sac may suppurate and burst, and so endanger life.

The death-rate in 274 cases of operation for disease of the tubes, collected by Schlesinger, was found to be 8.76 per cent. Of these, 20 operations were said to have been for cancer of the tubes (note that Martin does not mention a single case of this disease); 115 for pyosalpinx; 46 for hydrosalpinx; 19 for hæmatosalpinx;

43 for salpingitis; 7 for tuberculosis; and 23 for papilloma. This list must be very far from complete; the operation has been performed in Great Britain alone more than 500 times. I doubt also whether the proportions of the varieties of diseased conditions would be found to hold good over a greater number of cases. The general mortality is, however, probably near the truth; if anything, rather favourable than otherwise. Special mortality in the hands of a few operators, covering nearly 300 operations, would be found considerably under 5 per cent.

Fallopian Pregnancy.—Most men are now agreed as to the truth of Tait's opinion, that all examples of extra-uterine gestation are in the beginning either wholly or partially Fallopian. The risks of rupture before the fourth month are very great; and danger to life has by no means passed when the ovum is killed, by electricity or otherwise.

I hold strongly to the belief that as soon as an extra-uterine pregnancy has been diagnosed, operation ought to be performed. Though Thomas and others claim to have diagnosed the condition before rupture (and their diagnosis has in several cases been verified by subsequent events, not always favourable to the patient however), it is unfortunately the case that the first sign of it usually appears at rupture, when the woman is dangerously ill from intra-abdominal bleeding and shock. In such an event it would be a surgical crime to let the patient die without an attempt at relief. But under all circumstances, the safety of the patient, immediate as well as remote, is best consulted by removing the ovum with the tube at the earliest possible period. According to Parry, the mortality of extra-uterine pregnancy is 67.2 per cent.; early operation in competent hands would certainly give a death-rate of not more than 5 per cent. In the hands of Tait, whose operations have all been at the time of rupture, the mortality has been very little greater than this. In America, where electricity is in vogue for these cases, the successes claimed rest on doubtful diagnosis, and even then they do not equal those after operation.

CONDITIONS MAINLY UTERINE.

Of these, the condition requiring operation most frequently is myoma, or uterine fibroid. The exact position of the operation for uterine myoma is not yet fixed. It has been much discussed and written about at meetings and in journals; and the general outcome of the discussion has been that cause for interference resides, not so much in the tumour itself, its size or situation, as upon the symptoms it produces.

Uterine myoma has many phases. We find it frequently in post-mortem examinations of patients who have died of something else, and in whom it produced slight or no symptoms during life. We find it of moderate size in young women, where it causes excessive metrorrhagia, completely or partially disabling them. And most frequently of all it is met with in women near the menopause, as a large slow-growing mass, prolonging the periods and causing excessive flow, but not endangering life or causing much disablement. Lastly, we have a class in which the tumour goes on growing till it reaches dimensions so great as to interfere with the vital processes. The rapidly growing œdematous myoma of Tait deserves special mention. These groupings may be modified and interchanged in numerous ways; they broadly represent the conditions as most frequently met with, and that is all.

It is impossible, without fully entering into the whole question of the treatment of uterine myoma, to discuss the pros and cons of removal of the uterine appendages for it. The treatment has its origin in a *vera causa*—the atrophy of such growths with the natural atrophy, at the menopause, of the reproductive glands. By removal of the central glands we seek to produce atrophy of the organs whose functions are dependent on these glands. The results have been encouraging, and the operation is received with growing favour. Even in the hands of such skilled hysterectomists as Keith, Thornton, and Bantock, removal of the appendages is a favourite operation. Tait has always been its chief advocate in this country.

The indications for removal of the appendages cannot easily

be laid down in general terms. The leading indications are hæmorrhage and rapidity of growth. Circumstances of weight are the age and condition of the patient and the size of the tumour. In large tumours it is difficult, and sometimes impossible, to remove the appendages. If the patient is near the menopause, we may temporise, using the ordinary remedial measures; if the patient is under thirty-five, we must take into account the past history of the growth as to rapidity of enlargement and amount of hæmorrhage, and try to forecast the probable risks of leaving it. If the patient is married, the risks are increased from pregnancy. If she is in poor circumstances, forced to earn her living, operation may be indicated; while in a well-to-do patient, to whom chronic invalidism is not an unmitigated evil, it may not be indicated. With the above reservations, free bleeding, which cannot be controlled by ordinary means, is the leading indication for operative interference. If a growth of small size is growing rapidly and producing symptoms of its presence other than bleeding, and if the woman is some way off the menopause, we may interfere. And, finally, the possible effects of Apostoli's method of applying electricity must be taken into account.

The general mortality of the operation for myomata is somewhere near ten per cent. In the hands of individual operators it is, however, less. As to the results, we may, in every thirteen cases of recovery after operation, reckon upon complete cure—*i.e.* shrinking of the tumour and menopause—in ten cases; improvement in two; and failure in only one. But these results, with increasing care and judgment in the selection of cases and the period of operation, will no doubt improve. If cases of uterine myoma are kept under close and constant observation, and treated by removal of the appendages sufficiently early, the field of hysterectomy for this disease will become greatly diminished.

Certain congenital *anomalies and defects in the uterus*, associated with a normal development of the appendages, may be attended with moliminal disturbances so severe as to justify operation.

These are: complete absence of the uterus; embryonic, foetal or infantile uterus; the so-called "uterus pubescens." In these the menstrual functions subsidiary to well-developed tubes and ovaries cannot be properly discharged. There is, not retention, but a complete absence or imperfect establishment of the menstrual flow. The uterus is overburdened by its ovaries and tubes, so to speak, and at the periods of menstruation it gives no relief to their engorgement by bleeding. The moliminal pains in such cases are often very severe, confining the patient to bed, driving away sleep, and requiring the administration of opium or even chloroform. In the intervals there may be comparative ease; but frequently the pain spreads over these intervals as well, and the patient becomes broken down in health and glides into chronic invalidism. It is often possible in such cases to detect the ovaries enlarged, prolapsed, and tender, and the tubes are sometimes abnormally large as well.

The operation is sometimes performed for *incurable displacements of the uterus* when the symptoms are severe and irremediable. Retroversion and retroflexion, where the uterus has become adherent in its abnormal position, is the most frequent condition. The uterus is enlarged and tender, free bleeding takes place at the periods, pessaries are either useless or unbearable, or both, and other local measures, after prolonged trial, prove ineffectual. The patient is a chronic invalid, probably confined to bed or couch, and there is no prospect of cure. In such an extreme case removal of the uterine appendages, causing atrophy of the uterus, affords a fair chance of cure.

Insuperable obstruction to the flow of the menstrual fluid is sometimes an indication for removal of the appendages. In such cases there is extreme pain at the periods, and sometimes, according to Battey and others, even danger to life. Injuries during labour, such as extreme cicatricial contraction of the vagina, and destruction with occlusion of the lower part of the uterus, are the most frequent causes. Congenital imperforate uterus is another cause.

For *chronic inflammation of the uterus* and of the pelvic peritoneum, the uterine appendages have been removed with the view of

inducing atrophy of the organ. The whole uterus itself has been and, in an increasing number of cases on the Continent and in America, is removed for the same condition of incurable or recurrent pelvi-uterine inflammation. Such operations must often be a frank admission of surgical impatience; at all events, in these islands, where therapeutic measures not surgical have usually a prolonged and careful trial before operation is decided upon, these maiming operations have not gained a footing. As a last resort in the truest sense, and only as such, would operation be performed for this condition.

OPERATION IN NEUROSES.

The operation in *mania* has an extremely limited range. The proposal of Goodell to remove the ovaries from all female lunatics who have abnormal sexual propensities cannot be regarded seriously, any more than we should regard castration under similar circumstances in the male.* Certain cases of mania, in which the attacks come on solely or chiefly at the periods, and in which a sexual element strongly predominates, might, under very special restrictions, be properly treated by removal of the appendages. In puerperal mania, particularly if the disease has recurred after a second confinement, the removal of portions of the Fallopian tubes to prevent future pregnancy rather than complete removal of the appendages is indicated. For nymphomania the position of the operation is less assured. The operation has been performed for confirmed masturbation; but for this

* Castration for madness in the male has nevertheless been performed. Lazarus Riverius, "Councillor and Physitian to the King of France," in his collected works (1678) quotes, in the following terse and apt language, a case communicated by one M. Samuel Formius, "a most experienced chyrurgeon of Montpelier, having Practised the Art fifty years": "There was a certain young Man mad, and for his Cure the most effectuall Remedies were put in practice, so far as to the use of Antimony, the Trepan, and the opening of the Arteries of his Temples. And when all did no good, I (Formius) advised that he should be guelled; which being done, all Symptoms were abated, and his fury ceased quite; yet so that he continued in melancholy dotage, his madness being changed into Melancholy."

purpose it does not appeal strongly to the sympathies of the surgeon. Indeed, as the operation may not remove sexual feelings, it may not cure the habit.

In true *epilepsy*, the operation had not been attended with very favourable results. A few cases of recovery are recorded, but the accounts of these do not leave it certain whether the disease was true epilepsy or not. It is not sufficient to justify operation that the fits are worse or more numerous at the menstrual periods; this is true in many examples of confirmed epilepsy. Before operation is thought of, there must be a very strong presumption that the disease had its origin in perturbed sexual function, and the disease must not be so far advanced as to preclude the probability of cure. Actual disease in the appendages is an indication for operation.

In *hystero-epilepsy* there is, undoubtedly, a fair and promising field for operation. But here, also, the mere existence of the disease does not indicate operation. Clear and definite evidence of its connection with the sexual functions must be forthcoming. If the first fit occurred at the first menstruation; if subsequent fits occurred exclusively at the periods, and if they became intermenstrual only after having existed over several years; if there is an aura starting from the region of the ovaries; if the fits do not increase in severity; if they are unaffected by the bromides; and, finally and most important of all, if there is palpable disease of the appendages, we may consider the case as suitable for operation. The minor symptoms of hystero-epilepsy, such as muscular cramps and spasms and disturbances of sensation, are not of importance surgically. Of more importance are the general condition of the patient as to health, and her position in life—that is, whether she must earn her living or not. If the health is failing, and the patient is becoming a helpless invalid; or if she is absolutely precluded from supporting herself by her own exertions, and has no future but the workhouse, these we should rightly consider as additional indications.

In not a few of the cases where cure has followed operation, there has been very slight or no disease of the appendages; in others, uterine stenosis and incurable displacements are found.

The amount of disease does not *pari passu* increase the urgency of operation. Just as many women whose sexual organs appear to be perfectly normal, and who bear children, suffer more at their periods than others who are sterile from palpable disease, so may a slight amount of disease in one woman produce hystero-epilepsy, where in another it would produce no symptoms whatever. The index of excitability to reflex neuroses varies in different constitutions. In a sliding scale downwards, it is easy to reach the condition of no local disease at all, and speak only of disturbed function; and according to a good few reports, we must at present accept this functional disturbance as a real cause. But it is only provisionally so accepted; future investigations will probably displace it altogether.

For *hysteria* the operation has been performed, and with success. But operations of less severity than removal of the appendages have been successful in hysteria,—a small cut on the abdomen, for instances. For mere hysteria, even if accompanied by “convulsive attacks” or “dancing fits,” few surgeons would care to remove the appendages. The attacks would have to be very troublesome indeed, and the case would have to be surrounded by every conceivable inducement to operate, before interference could be contemplated.

THE OPERATION.

What will be the exact nature and extent of the operation depends partly on the disease for which the operation is performed, and partly on the end which the operator seeks to secure.

In diseases purely local and one-sided, such as ovarian hernia, single hydrosalpinx, simple ovarian abscess, uncomplicated prolapse of one ovary, and many examples of Fallopian pregnancy, there need be no hesitation in leaving the sound organs untouched. In double hydrosalpinx without adhesions, the ovaries may be left behind. But in all cases where nerve disturbances have existed for some time, we must reckon with the force of diseased

habit; and here complete delivery from pain may be secured by nothing short of complete abrogation of function. If a patient had been suffering for years from a small abscess in one ovary, the appendages being otherwise normal, her cure would almost certainly be more speedy and more complete if the whole of the appendages were swept away. The experience of Tait* and others is decidedly in favour of bilateral removal of the organs for inflammatory disease. After 26 cases of unilateral removal for inflammatory conditions, Tait found that a second operation was called for and performed in 4; that 5 cases of pyosalpinx had subsequently died, presumably from rupture of abscess of the other side; and that, in 7 others, a second operation would be required. In 13 out of 26 cases, the unilateral operation was a complete failure, and complete success could be chronicled for only 3, in the sense that the disease had not recurred on the opposite side. Each case must be judged on its own merits. The duration of the disease and the extent of it, the age of the patient, her position in life, her own and her husband's wishes, must all be taken into account.

It happens in most cases of inflammatory disease that the lesions are bilateral; and here the question is settled for us. In those cases where the motive is abrogation of function, or cessation of uterine bleeding, we have to decide between simple removal of the ovaries—oöphorectomy; and removal of both tubes and ovaries—salpingo-oöphorectomy.

Into a discussion of the influence which the tubes may possess over the function of menstruation I cannot here enter. Suffice it to say, that if Tait's theories have not everywhere been accepted, his practice has been very generally followed. The modern operation is removal of the appendages, and not merely removal of the ovaries.

Only practical considerations in support of this practice need be given here. A few of these are as follows:

(1) More than one case has been recorded in which removal of tubes without ovaries has been followed by menopause. One such case has occurred in my own practice. In this case meno-

* *Birm. Med. Rev.*, June, 1887,

pause was not sought. On the other hand, many cases of double oöphorectomy have not been followed by complete change of life. The best results published so far have been got from complete removal of the appendages.

(2) A better pedicle is afforded for deligation when both tubes and ovaries are included. A ligature surrounding the ovarian attachments alone is liable to cause kinking of the tube, with subsequent risk of occlusion or distension. The hilum of the ovary, with its plexus of vessels, is not satisfactory tissue for inclusion in ligature.

(3) By removal of the tubes, all further risks of disease in them are done away with. The ovaries can scarcely be removed without upsetting the blood-supply to the tubes, and causing some physical injury to them as well. Venous congestion or actual inflammation in the tubes might readily follow simple oöphorectomy, and nullify the benefits of the operation.

(4) The tubes are useless when the ovaries are removed. If one good reason for their removal can be given, and none for their being left behind, the question at issue is settled.

Removal of the uterine appendages may be either a very simple or a very difficult proceeding. If the organs occupy their normal situations and there are no adhesions, as in the cases to which the term castration may with least impropriety be applied, for small bleeding myomata, or absent or malformed uterus, or cystic ovaries, or such like, the operation is easy. If, as in inflammatory disease, they are displaced and matted together and to the surrounding organs, the operation may be one of great difficulty and delicacy. For large myomata, again, the operation presents special features which may cause difficulties; and finally, the proceeding in the case of ovarian hernia is peculiar to itself.

Where the Appendages are Anatomically Normal, or nearly so.—The incision, made in the ordinary median position between the umbilicus and pubes, need not be longer than an inch and a half or two inches—enough easily to admit two fingers. At the first or second cut the fibres of the linea alba are laid bare through the whole length of the wound. Pressure forceps are placed on any

bleeding points, and left attached. As the parietes are not thinned and distended by a tumour, the linea alba is very narrow, and it is not often that it can be divided without exposing one or both recti. A small opening is made in the fascia: if it is in the linea alba, well and good; if not, the layers are pushed to one side or the other, and when the situation of the fibrous septum is found, the fascia is slit up to the length of the wound by the point of the knife cutting forwards. The muscular fibres are pushed to one side with the left forefinger, and the sub-peritoneal fat exposed. This is caught up on two catch forceps, and carefully divided between them; and the rest of the division is made while the tissues are pulled out of the wound. The peritoneum is easily recognised: a small opening is made in it while it is thus everted; the finger inserted into this opening acts as a director upon which the division is completed, preferably by scissors. By this method there is no danger in wounding bowels: as each fold of tissue is pulled up and made tense, it is cut on its folded edge by the blade of the knife, held horizontally; and when the very smallest opening has been made in the peritoneum the air rushes in, and the bowels, if they have been dragged forward by suction, fall back at once. With moderate care, there is not the slightest danger of wounding bowel: it is idle to use it as an argument against the operation, as one distinguished gynaecologist has done, that there is great danger of wounding the intestine.

The first two fingers are now inserted into the wound. If omentum covers the bowels, it must be dragged upwards; if not, the fingers are pushed straight down to the fundus uteri. The fingers, one on each side of the broad ligament, and grasping it between them, are now carried outwards till the ovary is felt; it is then lifted out of the wound, with its mesovarium and its oviduct. Still held in this position in the left hand, the Fallopian tube is pulled out as far as it will readily come, and the pedicle spread out for ligature. The parts to be removed are the ovary with its mesovarium, and the Fallopian tube in its outer three-fourths, with the double peritoneal fold in which it lies, and which contains also the parovarium and the vascular erectile tissue known as the bulb of the ovary. The ligature is

placed double by transfixing, as in ovariectomy. The inner pedicle contains the utero-ovarian ligament, the Fallopian tube somewhere near its isthmus, the spermatic artery and its veins, and the small branch which accompanies the Fallopian tube. The outer ligature lies at the retiring angle where the infundibulo-pelvic and infundibulo-ovarian ligaments meet, takes its half of the mesovarium, and also constricts the spermatic artery. In most cases no method of ligature is, in my opinion, superior to Tait's Staffordshire knot. The ligature is most conveniently placed by means of the bent pedicle forceps (Fig. 58) already described. After pushing it through the tissue closed, the blades are opened, the thread caught in the middle and a loop pulled back. The loop is then raised over the parts to be removed, and one of the free ends drawn through the loop and over it. The free ends are now caught in one hand and pulled tight, while the fingers and thumb of the other hand act as an opposing force at the site of deligation. The knot is then cast and tied tightly, either by the operator unaided, or with the help of the assistant, who pulls on one end of the ligature. The parts are then cut away, by successive snips of scissors, at a distance of about a third of an inch from the ligature. Before making the last cut the surface must be carefully inspected, to see that there is no bleeding. The pedicle is then dropped in. A more deliberate, and perhaps more clumsy, plan is, to catch the sides of the pedicle in fixation forceps, hand these over to an assistant, and apply the ligature below them. The same proceeding is then carried out with the appendages on the opposite side.

A small, thin, flat sponge is now placed over the bowels under the incision; and the sutures, three or four in number, are introduced.

When the Appendages are Inflamed and Adherent.—The previous operation is a very simple one. From first to last, in competent hands, it can scarcely occupy more than ten minutes. But it is a very different thing if the appendages are adherent or inflamed, or suppurating and matted together. Then the operation may be one of the most difficult in surgery. Even in

the hands of surgeons of the highest skill, it has not infrequently been abandoned as impracticable.

The first difficulty met with is, probably, that the appendages are fixed and cannot be drawn to the surface. They may be represented by an irregular conglomeration of cystic and cicatricial material, sessile on the broad ligament or in Douglas's pouch, and perhaps intimately adherent to bowels. They are beyond the reach of sight, however much the abdominal walls are depressed. To deal with such a state of affairs, one of two courses is open. The first is to enlarge the incision to five or six inches; to pull the bowels out of the pelvis and keep them up in the abdomen by one or more sponges packed under them; to pull the parietes apart by spatulæ, perhaps to place the patient in the Trendelenberg posture, and seek by a strong light to expose the parts to view, and operate by the aid of sight. This may be safe, but it is clumsy and difficult. If the parietes are muscular and firm, considerable force may be required to crowd the bowels into the abdomen; and to keep them there, even with the pelvis elevated, is still more difficult. And it is not easy at the bottom of the pelvis to perform delicate surgical manipulations with knife or scissors and ligature. Several operators have had recourse to the doubtful expedient of making space by turning the bowels outside the abdomen altogether.

The other course is that followed by Tait. As a result of his unrivalled experience, Tait has come to the conclusion that it is best to depend entirely on the fingers to deal with such a condition, relying on the skilled sense of touch to guide against the dangers of tearing bowel or other structures. To control bleeding he recommends sponge-packing. Firstly, the fingers map out the actual limits of the diseased organs; then these are gently separated from all surrounding organs, and gradually the mass is unfolded upwards from behind till the only attachment left is the proper pedicle of the parts to be removed. Even as thus separated the appendages will probably be found sessile on the broad ligament, so that they can be little more than brought within the range of sight. The broad ligaments are stretched tightly across the pelvis, and dragging on the appendages may

tear them. The pedicle ligature may have to be carried under the diseased parts at a considerable depth from the surface. If possible all the tissues are gathered together in one pedicle, as by the Staffordshire knot; but the puckering so produced may drag upon the opposite ligament to such an extent as to cause tearing. To tie in two parts almost of necessity tears open the tissues between them. It has happened to me in one case, while putting on a ligature, that the broad ligament was torn clean away from the side of the uterus for a distance of more than an inch.

In dealing with such a difficulty, Tait, always fertile in expedients, tells me that he is in the habit of pushing his finger down on the broad ligament, close to the pelvic insertion of it, and so causing a series of minute tears through the fibrous fasciæ and peritoneum, but leaving the elastic, distensile, and tortuous vessels uninjured.

I have in several cases found that an air bag inflated in the rectum greatly facilitated the operation by raising the whole pelvic floor.

The bleeding in these cases is sometimes described as being truly alarming, and I have had practical experience of this fact. Sponges are packed in everywhere as the adhesions are separated, and as the hæmorrhage is started. If, after the appendages have been removed, bleeding still goes on, a little solution of iodine on a sponge may be applied to the raw surfaces. Of course visible bleeding points are dealt with by ligature or forci-pressure. And it may sometimes be good practice to leave forceps attached to bleeding points for twenty-four hours or so, their handles being left outside. In all such cases the insertion of a glass drainage-tube for a day or two is advisable.

During the performance of these operations we must bear in mind the fact that adhesions between intestines may cause great pain. If it is possible to separate such adhesions without endangering the intestinal walls, the intestines should be set free. The separation must be done with great care and delicacy, and always, if possible, within the range of sight.

If an abscess or abscesses exist, extra care is necessary to avoid rupture of the abscess wall. It will be wise before beginning separation to aspirate the contents, and place a pressure forceps on the opening so made. In such cases the placing of sponges all round the diseased parts is peculiarly necessary.

For Uterine Myoma.—For small myomata the proceeding may be in no way different from the simplest operation. In fact, as the appendages are raised with the fundus, and the broad ligaments are usually soft and distensile, the operation may be rendered easier.

When the tumour is large, and especially when it is adherent, the difficulties may be great, even insuperable. Not a few such operations, begun as oöphorectomy, have had to be finished as hysterectomy. If the tumour grows away from the uterus, being sub-peritoneal and near the fundus, the appendages may be deep in the pelvis. Where the growth lies between the broad ligaments the ovaries will be elevated, and squeezed between the tumour and the parietes. In an unsymmetrical growth one ovary may be quite conveniently near the surface, while the other lies out of reach and behind. Indeed, we must expect an endless variety of situation, and in some cases be prepared not to find ovaries at all.

When one ovary is found, we must, before proceeding to remove it, find the other; and before removing one, we must be certain that it is possible to remove both. Having decided to remove the appendages, we rotate the tumour to one side, so as to bring the parts first to be removed as close as possible to the surface. The pedicle is secured in the ordinary way by a Staffordshire knot, or in any other way that seems suitable for the case. Thornton's plan, of not cutting off the first ovary till all manipulations are over with the second, is a good one: it minimises the risk of bleeding from the divided pedicle. Forceps are left attached to the appendages first ligated: the appendages on the other side are brought as near to the surface as possible by rotating the growth, tied, cut off, and covered with a flat sponge. The appendages on the other

side are then cut off, and also covered with a sponge. When the sutures have been inserted in the parietal wound, the sponges are removed and the wound closed.

For Ovarian Hernia.—When, from pain or symptoms of strangulation, it has become necessary to operate upon an ovarian hernia, it has been the usual custom to remove the herniated parts. The incisions are made as for ordinary hernia, and the appendages are removed according to the principles laid down. Mr. Lawson advises that the divided end of the Fallopian tube be fixed in the wound by a suture; this procedure seems to be no more necessary in operating here than by abdominal section. In most cases there will be found adhesions fixing the herniated organs in the sac. Hulke has operated upon a case in which one cornu of a bifid uterus lay in the sac with the appendages, and "the inguinal portion of the uterus was invested by peritoneum, which passed directly into that of the hernial sac, and thus fixed the organ *in situ*." In herniated ovaries which are easily reducible there is danger of their slipping into the abdomen during operation: to avoid the risk of this, it is suggested that a needle be passed behind the ovary to fix it—a proceeding which is open to the objection that bowel may be pierced. In some cases where the hernia only occasionally takes place, it may be most expedient to remove the appendages by abdominal section.

The more perfect surgery of to-day would prefer, wherever possible, the liberation and return of herniated organs which are not incurably diseased; and the perfected completion of the operation by performing the radical cure. It is a clumsy cure that removes the organ which herniates, instead of closing the opening through which the hernia takes place.

Ligature instead of Removal.—In cases where removal is extremely difficult, or impossible, the proposal of Professor Simpson, to strangulate the blood-supply by ligation, is worthy of a trial. In his hands, and in the hands of Leopold of Leipzig and others, it has done good. Dr. Geza v. Antal, of Buda-Pesth,* urges atrophic ligature of the ovaries, not only for

* *Centralbl. f. Gynäk*, 1882, No. 30.

uterine fibroids, but for uterine versions or flexions, ovarian displacements and other conditions. More than one writer has suggested that the whole proceeding of removal of the appendages does good entirely by cutting off blood-supply.

Removal by the Vagina has now practically been abandoned, and need not be described. I have once operated in this way with success.

PROGRESS AFTER OPERATION.

The progress immediately after operation in all essential particulars so closely resembles that seen after ordinary ovariectomy, that it need not be described. Two peculiarities may be mentioned—pain and uterine hæmorrhage.

After removal of the appendages there is usually, for a day or two, considerable pain in the hypogastrium, far more than is seen after removal of cystomata. We ought to be chary of having recourse at once to opium. Flatulence and sickness are such frequent sequences of opiates, however administered, that it is always wise to postpone their administration up to the limits of the patient's endurance. The pain soon passes off; it rarely continues over the second day. Battey used to divide the pedicle by *ecraseur*, to try and do away with this pain; statements as to the success of his practice are not published. If there is restlessness or jactitation, opium is specially indicated.

On the second, third, or fourth day after operation we may expect bleeding from the uterus to take place. The bleeding is usually considerable in amount, and may continue over four or five days. It is in no way harmful; indeed, it is usually accompanied by amelioration of the subjective symptoms. Some surgeons consider it part of the cure in the operation for myoma. It requires no treatment, and need cause no anxiety.

REMOTE EFFECTS OF THE OPERATION.

The individual results of the operation as performed for specific disease have already been described, and the general results so far as they affect the feminine attributes have been sufficiently

discussed. It remains shortly to give an account of the behaviour of cases, with particular reference to the uterine functions and with general reference to bodily health as observed for a year or more after operation. Each disease has its own record, and all diseases have points in common.

For inflammatory disease, which is perhaps the most satisfactory source of operation, the record is broadly as follows:—At the end of a fortnight or three weeks the patient will probably express herself as feeling peculiarly well, and will be anxious to get up. When she has been getting about for a week or so, and at the time when menstruation is due, she will probably complain of backache and feelings of weight in the hypogastrium, and possibly her spirits may become a little depressed. Most probably there will be *molimina*, but no menstrual flow. During the next month slight backache, with some general weakness, may be complained of; and somewhere near the next period these symptoms may be aggravated. These cases do not get quite well very quickly as a rule; and this, of course, is not to be expected, considering their previous prolonged illness. In from three to six months perfect recovery may be expected. But all the old pain will have disappeared; and this alone, even in the most tedious cases, the patient will say was more than enough to justify operation. Regular menstruation is very rare, irregular and slight bleedings are more common; neither is likely to continue over more than six months. In a considerable majority *amenorrhœa*, immediate and permanent, follows the *metrorrhagia* which occurs a few days after operation.

In myoma the result is very variable as to subsequent course. There occurs the ordinary *metrorrhagia* immediately after operation. Thereafter we may expect complete arrest of menstruation, with, at first, cessation in the growth of the tumour, and then slow but steady diminution in size. This shrinking is by no means confined to small tumours, and it is rarely possible to tell what tumours will shrink and what will not shrink.

There is one variety of myoma—the soft, *œdematous*—which, Tait tells us, goes on growing after removal of the appendages, and which can be treated only by hysterectomy. I

can find no definite information as to the utility of removal of the appendages after the period of the menopause has passed; and it would be dangerous, considering how little we really know of their functions even when supposed to be physiologically inert, to speculate as to the possible benefits to be derived from the proceeding. A tumour may not show signs of diminution in size for several months, when it may begin to decrease in bulk and go on decreasing over one or two years, and then reach dimensions which are stationary.

For the neuroses, the results are at once highly encouraging and deeply disappointing. The balance, however, lies chiefly on the side of encouragement. The failures have been chiefly in cases of epilepsy; and here, no doubt, errors arising from an improper selection of cases have been most numerous. In favourable cases we are not to expect complete and perfect cure from the beginning. For the first few weeks there may be a complete cessation of the abnormal nerve-phenomena; at the time of the next period there may be a few fits; then in diminishing numbers a few more fits, lasting over several months. Perfect recovery must not be counted upon within six months at least; and this recovery must be encouraged by strict attention to regimen and surroundings.

Battey, at the twelfth annual meeting of the American Gynæcologists, held in New York, September 15th, 1887, read a paper on the matured results of 54 cases operated upon by him. His conclusions seem to fairly and clearly state the experience of others. He says:—

- (1) That the change of life is the most important factor in securing the complete result of the operation.
- (2) That only in exceptional cases did cure immediately follow operation; in the vast majority the patient had to pass through the ups and downs incident to the change of life before the restoration to health was complete. This period lasted from one to five years.
- (3) Very long standing cases reach a stage when they become absolutely incurable by any operation.
- (4) In some cases which seemed suitable for operation the pain continued; and his experience has not yet taught him how perfectly to select the cases.

Conservative Operations on the Ovaries and Fallopian Tubes.

Up till recent times the surgery of the ovaries and tubes has been almost entirely destructive; the diseased organ has been completely removed. And so it has been with herniæ of ovary or tube; the organ has been removed. The more thorough and perfect surgery of to-day reminds us that removal of the disease need not always be removal of the organ, but that in a certain percentage of cases it may be possible, while eradicating the mischief or putting the organ on the way to spontaneous cure, to leave functionally active organs.

Polk of New York has been one of the first to advocate the conservative surgery of the uterine appendages; Pozzi of Paris, Martin of Berlin, More-Madden of Dublin, Butler Smythe of London, and many other surgeons have practiced and advocated it. Their tenets have received a theoretical and if not a practical assent from most surgeons; the difficulty is to decide when and how to carry them out.

In the ovaries conservative surgery may be followed in the treatment of tumours, abscess, and simple cysts.

In the case of tumours conservative surgery is possible only with those of small size. It may happen that at the base of the growth a piece of evidently healthy ovary is seen; the tumour may be amputated above this, and the ovarian flaps folded in and sutured together. Such a portion of ovary may be functionally perfect. The case of Sippel* is clear proof of this. The patient was a woman of thirty, who had one child five years old. Her right ovary was as large as a child's head, showed no normal tissue, and was completely removed with the tube in the ordinary way. Her left ovary was the size of a goose's egg, and showed at the hilum a piece of normal tissue. The diseased portion only was amputated; the healthy portion, one inch long and one-eighth of an inch thick, was left, the raised surfaces being

* *Centralbl. f. Gynäk.*, iii., 1893.

folded face to face and united by sutures. The tube was left untouched. The woman became pregnant, and was safely delivered. Martin* speaks of twenty-seven cases treated in this way. There was one death and two relapses; eight of the patients bore children. Pozzi† records twelve cases of resection of only the diseased portion, leaving the healthy, and is satisfied with the result. He assures himself of the patency of the tube by passing a probe along it, and occasionally sutures the fimbriated extremity to the remains of the ovary, to assist the ovum in entering the duct.

In the case of simple cysts of the ovary evacuation, or this with ingi-puncture, has given good results. The walls of the sac might be removed if large enough.

In the case of abscess, simple evacuation with cleansing of the walls of the cavity, may, in carefully selected cases, be adopted. Drainage of such an abscess, either deep in the pelvis or after fixation in the parietal wound, would result in permanent fixation of the ovary by adhesions, and this, we know, is in itself the cause of much trouble. If drainage seems essential the organ had better be removed. Suppuration in glandular organs, such as the ovary and testis, is likely to start from several centres; multiple abscesses forbid evacuation, and demand removal. Now it is very difficult to be certain that an ovarian abscess is single; in any case of doubt the whole organ should be removed. The Fallopian tube need not be removed if it is healthy. But the risks of stenosis either from peritonitic new formations or kinking by ligation of the ovarian pedicle must be borne in mind.

Herniated ovaries may be returned even if strangulated, and need not always be removed. Aüe‡ was able in one case, after laying open the whole inguinal canal and resecting the dilated parovarium to free the ovaries and return them into the abdominal cavity. Hernia existed on both sides, and radical cure was performed on both sides. A few similar cases are recorded.

* *Deut. Med. Woch.*, July 27, 1893. † *Ann. de gyn. et d'obstet.*, Mar., 1893.

‡ *Centralbl. f. Gynäk.*, xxxv. 1892.

Herniated Fallopian tubes, if not strangulated, may be returned with the ovaries. But strangulation is liable to be associated with suppuration in the lumen or interstitial tissues, and return inside the abdomen should then be made with great caution. Hernia of the Fallopian tube is usually associated with hernia of the ovary as well; and these tubo-ovarian herniæ are nearly always inguinal. Herniæ of the tube alone has a greater proportion of cases femoral, and is more liable to be strangulated than tubo-ovarian. Thus Lejaro,* in a report of eleven cases of hernia of the Fallopian tube gives five as femoral, and five as being acutely strangulated. He favours removal for most cases.

Simple cysts of the Fallopian tubes may be evacuated, with removal of parts of the cyst walls: but such a proceeding claims no real advantage over removal; indeed, it has self-evident disadvantages in the chance of recurrence and formation of adhesions.

The question of the conservation of the whole or part of diseased ovaries and tubes is one that can scarcely be discussed in general terms. Speaking broadly, I think the clearest possible evidence that cure will be efficient and relapse not likely should be forthcoming before any part of the organs is left behind. We know that ovarian cysts may originate at several points, and that abscesses both in tubes and in ovaries are likely to be multiple, the smallest being microscopic. Absolute safety follows complete removal only; it is not worth while running the risk of recurrence where there is the slightest doubt. Conservatism has most claims where disease exists on both sides. Moderate risk of imperfect cure or recurrence might be run in the effort to leave behind some working portion of the uterine appendages.

In the case of *peritonitic adhesions* fixing the ovaries and tubes to surrounding organs, and associated with pain, removal is called for only in the worst cases. I have on several occasions got satisfactory results from careful and thorough separation of adhesions that bound down ovaries and tubes, and many similar cases are now on record. Such adhesions are liable to reform; but if the

* *Rev. de Chir.*, Jan., 1893.

bowels are kept actively moving, and the uterus is frequently pushed upwards and moved laterally, they are not likely to be harmful. Long thin adhesions seem to cause more trouble than short firm adhesions completely fixing the organs; their division however gives the most perfect cure.

SECTION IV.

OPERATIONS ON THE NON-GRAVID UTERUS.

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OPERATIONS ON THE NON-GRAVID UTERUS.

IN this section we have to consider removal of the uterus, or parts of it, for disease; and fixation of the uterus for misplacement. Removal of the uterus—Hysterectomy—is performed for malignant disease, for myoma, and for incurable inversion, rarely also for inflammatory disease. The operation of removal is named according to the purpose for which it is performed—Hysterectomy for myoma, for cancer, for inversion. The operations for fixation of the uterus are known as Hystero-pexy: several methods of performing this operation are described.

Surgical Anatomy of the Uterus.

The relational anatomy of the uterus is of extreme practical importance. It is chiefly the close contiguity of important structures, such as the ureters and the bladder, which renders removal

of the uterus such a difficult and delicate proceeding. No surgeon ought to attempt the operation of hysterectomy who has not previously made himself familiar, by study, dissection and operation on the cadaver, with every anatomical and technical detail.

The ligaments of the uterus have already been sufficiently described; here we have specially to consider its vascular supply, and its relations to bladder, ureters, rectum, and peritoneum.

Over the fundus uteri the peritoneum is closely adherent. In the front, as it descends to the junction of the body and the cervix, it is less intimately attached to the muscular tissue; and, at the bottom of the vesico-uterine depression, it is so loosely attached that it can readily be stripped off with the finger. Here is the most important surgical region. The reflection of peritoneum from uterus to bladder is usually at the level of the internal os, but it is liable to be elevated or depressed. (Fig. 64.) In children it is higher up, in multiparæ and old women it is lower down, than the average level. In close relation with the under surface of the vesico-uterine pouch lie the base of the bladder, and the ureters imbedded in cellular tissue. The bladder wall, for a distance of

fourteen millimetres, lies on the cervix uteri; below this, as far as the pubes, it rests on the vagina. Courty found, as the result of a great number of measurements taken at all ages, that the distance between the opening of the ureter into the bladder and the insertion of the vagina into the cervix was on an average between



FIG. 64.

Vertical antero-posterior section of the uterus. (COURTY.)

i, isthmus separating the cavity of the body from that of the cervix; *a*, anterior lip of the cervix; *p*, posterior lip; *f*, posterior vagino-uterine cul-de-sac; *va*, *va*, vagina; *b*, *b'*, connections of the urinary bladder with the anterior surface of the cervix; *r*, reflection of the peritoneum from the posterior surface of the uterus and vagina to the rectum; *c*, commencement of the utero-lumbar suspensory ligaments.

one and two centimetres in length. The distance between the margin of the uterus and the ureter varies according to the size of the cervix, and also according to the condition of the bladder as to emptiness or distension. With an empty bladder and a normal uterus a distance of quite half an inch may be reckoned upon as separating the cervix from the insertion of the ureter into the bladder wall.

The peritoneum covering the posterior surface of the uterus is continued over the utero-sacral ligaments, and carried down for about three-quarters of an inch over the posterior vaginal wall,

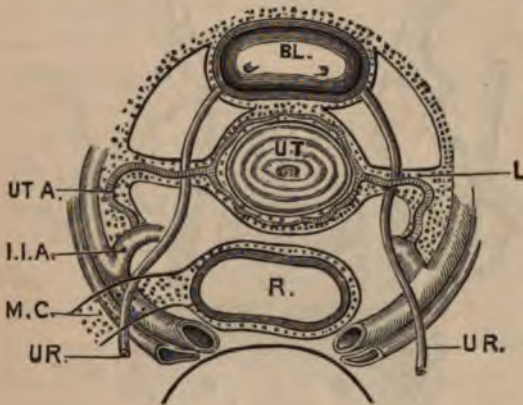


FIG. 65.

Diagram to show relations of uterus, bladder, and ureters in transverse section.

BL., bladder; UT., uterus; R., rectum; UT.A., uterine artery; I.I.A., internal iliac artery; M.C., meso-colon; UR., ureter right and left; L., broad ligament. Areolar tissue dotted.

when it is reflected up the rectum, forming Douglas's pouch. Though the sub-peritoneal cellular tissue is not so abundant behind as in front, the peritoneum can be readily peeled off as high as the level of the internal os.

The cellular tissue lying between the folds of the broad liga-

ment is continuous below with that which ascends in front over the lateral surfaces of the bladder up to the hypogastrium, and that which descends behind over the levator ani and upper perineal aponeuroses. In this cellular tissue course the uterine vessels and the ureters. (Fig. 65.)

The uterine artery, a branch of the anterior trunk of the internal iliac, passes obliquely downwards and forwards from its origin near the symphysis towards the spine of the ischium.

Just above the ischial spine it leaves the pelvic wall, but continues to descend half-way to the tuberosity of the ischium, where it turns upwards, bending towards the vagina to which it gives branches, and reaching the uterus at its junction with the vagina.

It runs up the side of the uterus between the folds of the broad ligaments, supplying the organ with vessels, and finally anastomoses with the ovarian artery near the cornu. (Fig. 66.) Opposite to the external os the uterine artery gives off a considerable branch, the circular artery of the cervix, and it gives off other branches in its course upwards. Throughout its course the vessel is tortuous and loosely supported by cellular tissue. At its lowest

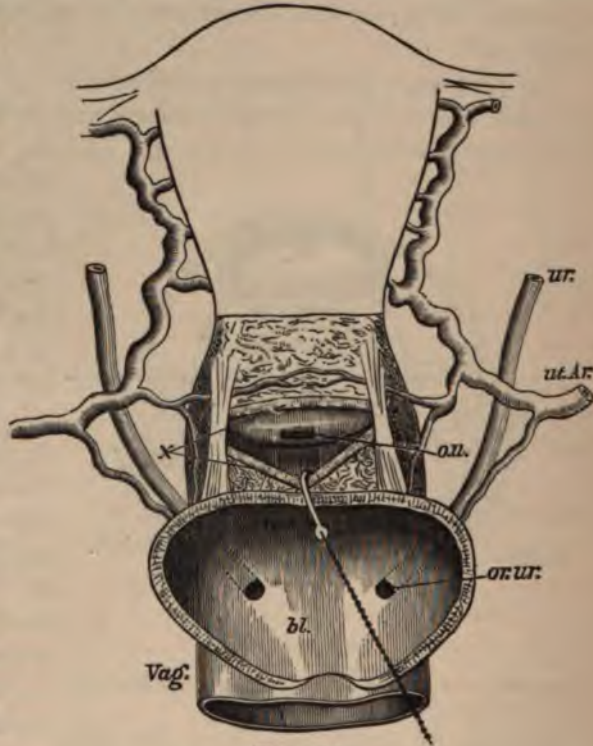


FIG. 66.

Drawing from a dissection made to show relations of ureters, uterine arteries, bladder, &c.

ur, ureter; *ut. Ar.* uterine artery; *o.l.*, os uteri exposed by an incision, *x*, made through the top of the vagina; *bl.*, bladder, the walls of which are cut away down to the insertion of the ureters into its base; *Vag.*, vagina. Two bands of fibrous tissue are seen passing between the cervix uteri and the top of the vagina. Arterial branches of considerable magnitude accompany the ureters. The space between the bladder wall and the unshaded body of the uterus (artificially enlarged by traction of hook) is covered by peritoneum, in the loose cellular tissue underlying which the bladder wall rises upwards to a varying distance.

chies in its course upwards. Throughout its course the vessel is tortuous and loosely supported by cellular tissue. At its lowest

point it is on a level with the external os, and here it passes directly over the ureter, almost in contact with it, but not at all attached. The lateral branches given off to the uterus by the uterine artery are so numerous that local compression from flexions or other causes can scarcely render any part of the organ anæmic.

The ovarian or spermatic arteries arise from the aorta below the level of the renal arteries, and cross the pelvic brim at, or in front of, the bifurcation of the common iliac, crossing the ureter, and running along the upper border of the broad ligament to the cornu. More exactly they may be said to lie between the folds of the infundibulo-pelvic ligament. In the round ligament is a branch from the epigastric artery which reaches the uterus.

Although the uterine artery is usually larger than the ovarian, the reverse is occasionally the case. Their relative dimensions are liable to endless variation.

The relations of the ureters to the uterus are of prime importance. The researches of Holl, of Innsbrück,* Garrigues (quoted by Hart and Barbour) and Polk,† painstaking and thorough as they are, by no means agree. Mr. J. Collier and Prof. Morrison Watson, quoted by Dr. Thorburn,‡ have given a description of the course of the ureters, which I have several times verified by dissection, and which, I think, may be trusted. Entering the pelvis, the ureter crosses the common iliac near its bifurcation, and then runs downwards and forwards in front of the internal iliac and its anterior division. Where this division of the internal iliac splits into its branches, the ureter bends backwards and is crossed to the inside by the uterine artery. (Fig. 66.) The ureter then turns forwards at the level of the internal os, and at a distance of about half an inch from it runs along the side of the vagina for a little way, finally bending over it so as to enter the junction between the vagina and bladder. It perforates the latter organ just above the middle of the anterior vaginal wall, and obliquely enters the viscus a little lower down. (See further, "Surgery of Ureters.")

* *Wiener Med. Woch.*, Nos. 45 and 46, 1882.

† *New York Med. Journ.*, xxxix., 1884, p. 487. ‡ *Dis. of Women*, 1885, p. 534.

Hysterectomy for Malignant Disease.

History.—It is probable that excision of the uterus was practised by the ancient Greeks, but it is certain that the operation was subsequently forgotten. Soranos of Ephesus, in his book on *Diseases of Women*, published a century before Christ, speaks of the operation. It is probable, however, that it was performed for prolapse only. We hear nothing of hysterectomy till 1560, when Andreas a Crucé is said to have performed it. In 1813 Langenbeck successfully removed the whole uterus, for what was supposed to be cancer. The reality of his operation was questioned; but, when the patient died nearly thirty years later, it was proved at the post-mortem examination that he had removed the whole organ. Mikulicz* tells us that one Gutberlet received a prize in Vienna, in 1814, for proposing a mode of removing the uterus not unlike that of Freund. In 1822 Sauter of Constance had the first successful vaginal extirpation for cancer; but a urinary fistula remained. In 1828 Blundell recorded four cases of removal of the uterus for cancer, only one being successful. In 1829 Recamier registered one success; but this was followed by failures in the hands of Siebold in 1831, of Delbech in 1839, and others; so that the operation fell into disuse till 1879, when Czerny,† struck with the report of Langenbeck's case, re-introduced the operation with a success. Billroth, Mikulicz, Schroeder, Condereau, Hennig, Freund, and others, soon followed; and the operation now took its place among established proceedings in surgery.

Freund struck out a new path for himself by using abdominal section. Credé modified Freund's operation by making a resection of the pubes. Massari, Spiegelberg, Baum, and others, proposed modifications more or less ingenious. But Freund's operation has died out. It has had a mortality of nearly seventy per cent. in 106 published cases, and it has been almost univer-

* *Wiener Med. Woch.*, 1880, No. 47, et seq.

† *Zeitschrift für Geburtshilfe und Gynäkologie*, Bd. vi. Heft. 1., 1881.

sally discarded for the vaginal operation—Kolpo-hysterectomy (*κόλπος* = vagina). To the latter operation we shall therefore confine our attention.

Mortality and Appreciation.—By some authorities the operation of removal of a cancerous uterus is absolutely condemned as unjustifiable. The objections offered are mainly on three grounds—the high death-rate, the liability to recurrence, and the favourable results got from partial removal.

According to Petrow,* kolpo-hysterectomy has been performed 599 times, with a general mortality of 18.7 per cent. This death-rate is spread over nearly 50 operators. Martin† collected 311 cases, reported up to the end of 1886, with a general mortality of 15.1: this, I think, must be a little too favourable. The papers of Post‡ and Dudley gave a total of 381 operations, with a per-centage mortality of 20. The most recent statistics, dealing with over a thousand cases, give a mortality of between 10 and 14 per cent. Thus, Binnie gives in 1479 cases a 9.4 per cent. mortality. Byrne's statistics (quoted by Jessett,§ including 1273 cases give a mortality of 14.6 per cent. In the hands of ten of the best surgeons 200 operations would be found to have a mortality of under 10 per cent. Now, it may be pointed out that ovariectomy itself, in the first 200 operations performed by a few selected surgeons, had a mortality greater than kolpo-hysterectomy has had. And it is certain that if the combined results of all operators at the present day were tabulated, the death-rate would be nearly as large for ovariectomy as for kolpo-hysterectomy. The statistics of individual skilled operators in excision of the uterus are nearly as favourable as the average statistics of ovariectomy. Thus, Brennecke has had 21 cases, Rubeska 28 cases, and Staude 16 cases, all successful; Fritsch lost 7 out of 60 operations; Martin lost 11 out of 66 operations; Leopold lost 4 out of 80; Kaltenbach lost 1 out of 30; Muenchmeyer lost 4 out of 80; and Sanger, Olshausen, Leopold, and a few others have had results nearly as brilliant. Dudley||

* Abstr. in *Amer. Journ. Med. Sc.*, c., 1890, p. 318.

† Tr. Inter. Med. Congress, 1887, Vol. ii., p. 788.

‡ *Internat. Journ. Med. Sc.*, xci., 1886, p. 113.

§ *Med. Press & Circ.*, lv., 1893, p. 248. || *N. Y. Med. Journ.*, xlv., 1887, pp. 35, 66.

has collected 38 cases of operation done in America by 22 surgeons, with 13 deaths. It should be noted that Bernays of St. Louis had 6 cases, all recovering; and Bull of New York, 5 cases, with one death. It will therefore be seen that, in skilled hands, the operation is far from being unjustifiable on account of its mortality. The operation has suffered at the hands of untrained operators; but the operation itself must not therefore be condemned. Personally I can speak only from a small experience of 15 cases for epithelioma, with no death. But from the manner of recovery in these cases, which were of average character, I would infer a legitimate mortality of certainly not more than 10 per cent.

With regard to the objection urged against hysterectomy, that the disease is extremely liable to recur, we have no trustworthy data to argue from. The objection holds good against all operations for malignant disease; and there is no evidence to show that this recurrence is more likely to take place after excision of the uterus than after other excisions for cancer—of the tongue, for instance. Reasoning on theoretical grounds we might infer that an organ, so much differentiated as the uterus, would be as likely as any to have the disease limited for a definite period. As a matter of fact, in those cases where the after-results have been carefully noted, as in Fritsch's, Leopold's, Schroeder's, and Martin's, the per-centage of permanent cures is fully equal to that got after extirpation of cancer in other regions. No doubt recurrence has taken place more frequently and more rapidly than it ought to have done, because unsuitable cases have been submitted to operation.

Partial or cervical amputation is sometimes compared with total amputation, to the disadvantage of the latter. No fair comparison is possible. As well might we compare excision of a small epitheliomatous ulcer of the tongue with removal of the whole organ. The operations are quite distinct. Where the one is proper, the other is improper; where the minor operation is likely to succeed, it would be wrong to perform the major. And in the case of cancer of the uterus, the minor operation is, in the majority of cases, the proper one; my own experience is,

that for three cases in which partial excision is the proper operation, total excision is called for only once.

It should be noted that certain authorities maintain that total removal should be adopted for all cases of cancer of the uterus, even in those cases where the disease is confined to the cervix. Fritsch, in particular, has identified himself with this view; and gives as reasons, in addition to the admitted ones after the partial operation, the somewhat remarkable one that total extirpation is less difficult and less bloody than cervical amputation. He would operate, however, only when operation is easy; that is to say, when the uterus can be easily drawn down. Fritsch's experience and his extraordinary success in the operation give his opinion great weight. Additional strength has been given to Fritsch's position by Schuta of Prague,* who states that 70 per cent. of the patients submitted to total extirpation remained free of the disease one year after operation, while only 50 per cent. remained free after the partial operation. After two years 100 per cent. of the survivors were free after the radical operation, while only 40 per cent. were free after the partial one. These statistics, however, require corroboration and extension.

I have no hesitation in expressing my belief that, in carefully selected cases, the operation is both justifiable and proper. The immediate mortality does not forbid it. Recurrence is almost certainly not more rapid than in other operations for cancer, and permanent recovery is just as likely to be secured. And, finally, there seems to be an almost unanimous opinion that death after recurrence is not attended with so much suffering; that perforations of bladder and rectum are not so liable to take place after the uterus is removed; and that existence is prolonged.

* *Wien. Med. Presse*, July 3rd, 1887.

CONDITIONS FOR WHICH OPERATION MAY BE PERFORMED.
INDICATIONS AND CONTRA-INDICATIONS.

The varieties of malignant disease for which excision of the uterus may be performed are: epithelioma, scirrhus, encephaloid, and sarcoma.

Epithelioma may be found attacking the vaginal portion of the cervix, the cavity of the cervix, or the interior of the body of the uterus. The varieties may be clinically spoken of as epithelioma of the os, the cervix, and the body. On the os the diagnosis is easy. The characteristic hard, nodular, friable, and vascular granulations, and the proneness to hæmorrhage on being touched, are, with the peculiar acrid watery discharges and certain other well-known symptoms, sufficiently diagnostic. In epithelioma of the cervix, the development of the cauliflower excrescences is hindered by the encircling tissues. The new growth infiltrates the parenchyma as hard nodular masses, leaving softened intervals of uninvaded tissue. Granulations may protrude at the os, or they may grow inwards towards the uterine cavity. The epitheliomatous granulations soon break down, and the cervical cavity becomes a large, open, rounded channel, with irregular nodulated masses bulging into it. Cancerous discharges are said to come on earlier, and to be more abundant, in this than in the previous form.

Epithelioma of the body, as a primary disease, is not so rare as it is frequently supposed to be. Its behaviour is very similar to what is found when the disease attacks the cervical mucous membrane. There is greater enlargement of the fundus, less marked hardening of the cervix, and it is frequently associated with symptoms of uterine contraction or spasm. The diagnosis is made certain by dilatation of the cervix and introduction of the finger.

✧ In every case of doubtful diagnosis, a piece of the granulations should be removed, and examined under the microscope.

As to operative treatment. In every case of epithelioma confined to the vaginal portion of the cervix, amputation of the cervix alone is, in my opinion, called for. And as the majority of examples of epithelioma of the uterus are of this limited nature, the greater number of amputations will be partial.

Cancer of the cervix may occupy the lower portion of the canal, or extend upward through its whole length. The selection of partial or total hysterectomy must depend on the extent of the disease. It is possible to remove the whole cervix and some part of the uterine body without entering the peritoneum, and in many cases it may be ascertained, with a considerable degree of probability, that such operation is well clear of the disease. But epithelioma in the cavity of the uterus burrows more extensively than on the os, and infiltration may have extended some distance beyond the limits of the superficial and palpable growth. Such cases can be cured only by total hysterectomy.

For epithelioma of the fundus and body of the uterus, total hysterectomy alone is permissible.

Parenchymatous cancer of the cervix may be either scirrhus or encephaloid: diagnosis between the two is rarely possible till the disease is too advanced for operation. It is known by the increased tumefaction of the cervical tissue; by its general density, marked at several points by masses of specially hard consistence; by the dark-red, angry colour of the visible parts; and by the tenderness on pressure. Scirrhus is harder than encephaloid, and is more liable to form multiple masses of induration. The progress in both is very rapid.

Scirrhus or encephaloid may attack the fundus, and may develop towards the uterine cavity or towards the peritoneum. In the early stages it is exceedingly difficult to diagnose parenchymatous disease of the body of the uterus from simple myoma. Undeniable evidence is afforded only when ulceration takes place. But much may be inferred from the urgency of the symptoms as to bleeding, pain, the rapidity of progress with attendant cachexia, and the nature of the discharges.

Sarcoma of the uterus is a rare disease, and is not easily diagnosed. Hæmorrhages, a watery discharge "like the washings of meat" (Schroeder), moderate enlargement of the uterus, often markedly in one direction, and rapid increase of the growth, suggest the disease. There may not be much pain, and such pain as is found is usually intermittent, and of the nature of uterine colic. The growth is soft, often semi-fluctuating, and it grows irregularly, while still continuing as one mass. In 1888 I removed, in the Bristol Royal Infirmary, a sarcoma of the uterus containing great quantities of blood-clot. The patient died within three weeks with secondary deposits in the lungs and suppurative peritonitis. In the beginning of 1890 I performed a similar operation, removing a mass of sarcoma as large as the fist. The patient made an excellent recovery, and the uterus was reduced to its normal bulk. This was intended as a preliminary to total removal; but the patient, with the chances of recurrence fairly put before her, decided against the operation. I have since then removed by the vagina a sarcomatous uterus from which a mass of tumour-growth had previously been removed; but the patient, who was in a very feeble state of health, did not recover.

In malignant disease of the uterus, where removal of the whole organ is contemplated, the grave nature of the operation demands that the indications and contra-indications should be peculiarly definite and unmistakable. They are in no way different from those in force with reference to malignant disease elsewhere; but the risk to life from the primary operation is so great, that special weight must be given to any element which is likely to interfere with success. The liability to recurrence in a given case of epithelioma of the lip may appear to be greater than in one of epithelioma of the cervix uteri after removal; but the immediate danger after operation from the one is so much less than after the other, that the one operation might be surgically permissible when the other would not.

Before proceeding to operation in any given case of malignant disease, the most careful and rigid scrutiny must be

instituted, not only into the amount of local disease and its limits, but into the general condition of the patient. Marked anæmia, evident cachexia, or a faulty condition of any of the vital organs or viscera, at once forbids operation. The patient must be in fair health, with a prospect of average longevity from general soundness of organs apart from the malignant disease.

Locally, a precise examination by vagina and rectum must reveal complete absence of extension of disease to any surrounding organ or gland, to peritoneum, broad ligament, bladder, or rectum. One finger in the rectum and another in the vagina may cause the cervix and the wall of the bowel to glide over each other; and a sound in the empty bladder may, to a less extent, elicit the same symptom for that organ. Bimanual examination will detect thickening of the broad ligaments and enlargement of glands. The uterus must be freely movable in all directions, and the movements ought not to be associated with severe deep pelvic pains. Local extension of the growth to the vagina, of course, contra-indicates operation.

CERVICAL AMPUTATION.

Although this operation for cervical cancer is not strictly within the limits of this work, and was omitted in the first edition, I now include it, because it is germane to what follows, and because it makes complete the account of the operative treatment of uterine cancer. I confine my description to a short account of the operation which I have performed for the past ten years with uniform success. The cases are too few (twenty in number) to draw conclusions from; but judging from the behaviour of patients submitted to the operation, I believe that one may go on operating with a mortality under 2 per cent.

The vagina is disinfected thoroughly by irrigation before operation, and by swabbing at the time of operation. The patient is placed in the lithotomy position and kept there by means of

Clover's crutch. (Fig. 67.) The cervix is caught in powerful locking volsella, by means of which the uterus is forcibly dragged down: these are handed over to an assistant, who directs the movements of the uterus according to the instruction of the surgeon. The only instruments necessary are, two Spencer Wells's large compression forceps, scissors curved on the flat, and a straight uterine probe.

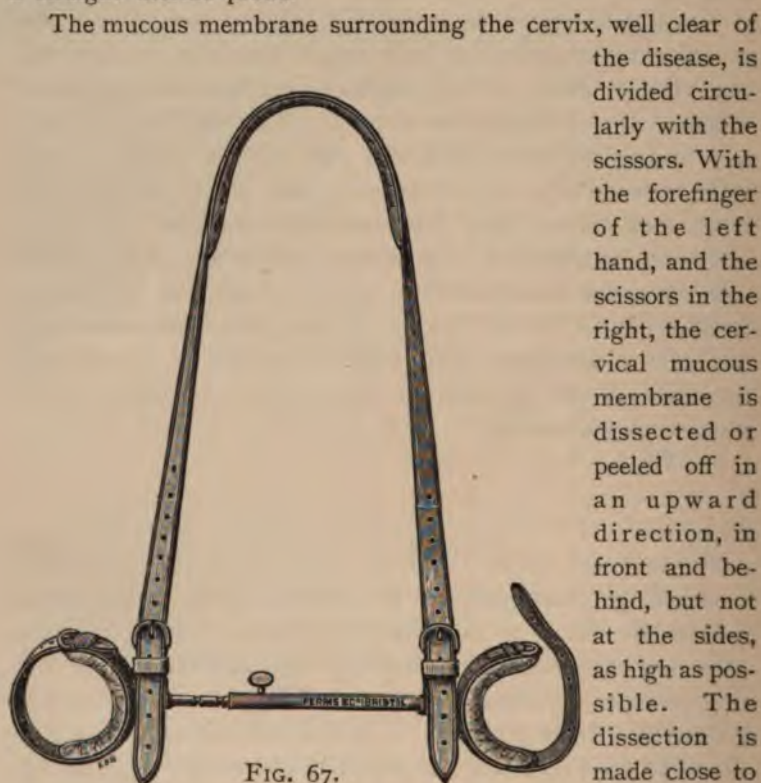


FIG. 67.

Clover's Crutch. One-eighth size.

The mucous membrane surrounding the cervix, well clear of the disease, is divided circularly with the scissors. With the forefinger of the left hand, and the scissors in the right, the cervical mucous membrane is dissected or peeled off in an upward direction, in front and behind, but not at the sides, as high as possible. The dissection is made close to the uterus in front to avoid

the bladder and ureters, and behind to avoid perforation of the peritoneum; the dissection may be carried higher in front than behind. Practice on the cadaver will soon enable one to judge by touch when the upward limits of safety have been reached; these are known by the increased resistance met

with. At the sides, where the broad ligaments are inserted and the uterine arteries are met with, no dissection is made, but cellular tissue is stretched and peritoneum is pushed aside. The cervix is now cleared of mucous membrane up to the limits of undetachable peritoneum: it must be noted, however, that the peritoneum at the sides is less closely adherent than in front and behind; and two pouches can be formed between the layers of the broad ligaments, higher up than the highest limits of the peritoneal reflexions from the uterus. The peritoneum is, in fact, stripped from the broad ligaments for some distance along the sides of the uterus; and between the two layers of peritoneum lies a stratum of cellular tissue containing the uterine vessels. This layer of undetached cellular tissue is caught between the fore and middle fingers of the left hand, and stretched laterally while the assistant drags the uterus in an opposite direction, thus clearing the lower sub-peritoneal portions of the broad ligament, which contain important vessels, for the application of the large compression forceps. The blades of the forceps are pushed as high up as possible in the tracks of the fingers and firmly locked, first on one side and then on the other. If there has been bleeding from the epitheliomatous tissue, from compression or tearing by the volsella, this bleeding at once stops when the forceps are applied. Indeed, the continuation of the hæmorrhage after the application of both pairs of forceps I should regard as indicating that they were not properly applied.

The cellular tissue between the forceps and the side of the uterus is now divided by scissors. Such division nearly always permits the uterus to be dragged down lower. The uterine probe is now placed inside the cavity as a guide to the lines of division. The uterine tissue is divided obliquely upwards by the scissors, the division all round converging to the probe as a centre. The fingers of the left hand push the loose tissues out of the way of the scissors, while the assistant manipulates the uterus by volsella and probe, so as to assist the division. The cervix and a considerable portion of the body of the uterus may be removed in this way without any trouble from hæmorrhage.

The uterine mucous membrane may be removed in its whole length without much difficulty, if it is divided while it is gradually pulled down after the muscular tissue has been cut through.

The gap in the uterus is swabbed out with an antiseptic lotion; a pad of antiseptic wool closes the vagina and surrounds the handles of the forceps, which are left *in situ*. In twenty-four or thirty-six hours the forceps are removed. Daily irrigation of the vagina may be continued for a week or longer, and in a fortnight the patient may be permitted to get up.

KOLPO-HYSTERECTOMY.

An extraordinary amount of literature has accumulated around the description of Kolpo-hysterectomy. Much of it represents early crude and tentative proceedings which have been generally ignored or abandoned; but some of the described methods have survived the natural processes of selection and evolution, and have now crystallised into generally accepted plans of operation. Finality has not yet by any means been obtained, and permissible variations in each step of the operation may be properly referred to.

The operation may be conveniently described in successive stages.

Preparatory.—Two or three days must be devoted to thoroughly cleansing the whole of the parts concerned in, and contiguous to, the seat of operation. The external parts, the folds between the labia at the top of the thighs and around the clitoris and pubes are washed at least once a day with soap (preferably with pure potash soap) and hot water. The vagina is irrigated twice daily with some trustworthy antiseptic, such as 1-30 carbolic acid or 1-1500 perchloride solution. After irrigation, iodoform powder is to be insufflated, and a plug of cotton wool, impregnated with antiseptic material (iodoform is suitable), is to be inserted and removed for the next irrigation. When the patient is placed ready for operation, a final and

thorough douching with a strong antiseptic lotion will be instituted. The bladder and the rectum are, of course, thoroughly emptied.

Some surgeons aim at a more thorough purification by removal of the granulations wherever situated, and by a curettage of the uterine cavity. An ordinary uterine scoop or Volkmann's spoon will serve to remove cauliflower growths on the cervix. For removing foul granulations inside the cavity Jessett's instrument (Fig. 68) is very convenient. It consists of a series of blades which can be opened up balloon-wise and by rotation remove the granulations. A few surgeons perform this minor operation some days before the major one. I am doubtful of the value of this proceeding in any except the worst cases where the growth is so exuberant as to obscure view and limit manipulation. I doubt if it is possible completely to purify an ulcerating cancerous surface in the vagina; I am confident that it is wise to act as if it were still impure. If the uterus is turned over, risk of infection is avoided by placing a sponge between the cervix and the peritoneum; if it is not turned over, the foul cervix may be covered by lint impregnated with a liquid antiseptic. In every case the loss of blood from scraping must be seriously regarded as a source of weakening for the patient. The best reason for removal of cauliflower masses is to increase the space for operation: in some cases the upper vagina is completely blocked by growth; here curetting is essential.

The best *position of the patient* is that of perineal lithotomy; and the posture is best maintained by Clover's crutch (Fig. 67),

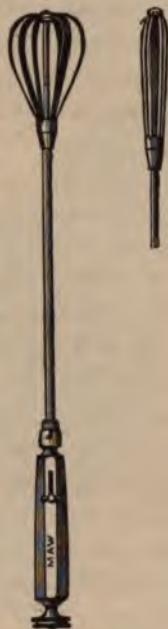


FIG. 68.

Jessett's Dredger for removing foul granulations in cases of epithelioma of the uterus.

The instrument is shown open on the left; closed for introduction, on the right.

which keeps the knees apart, and maintains flexure of the thighs on the pelvis by means of a strap carried round the neck. Ordinary lithotomy straps, joining wrist and ankle, permit movements of the limbs, and require an assistant to keep them still. The table must be of convenient height, so as to bring the parts easily within the reach of manipulation and sight. A few surgeons prefer Sims's position.

Fixation and Manipulation of the uterus is managed by means of powerful volsella, with three or four broad interlocking teeth. Many surgeons recommend the use of a thick ligature, carried through the cervical tissue. But a ligature, however thick, is more liable to tear the tissue than volsella of proper shape and dimensions; and an assistant cannot move the uterus about in the vagina, as the operator directs him, with so much rapidity and precision by a thread as by a strong stiff instrument. Volsella need be in the way of the operator no more than a string.

The surgeon pulls down the uterus as far as possible by means of the volsella, and then hands it over to an assistant. The next step is:

Dissection of the vaginal mucous membrane off the cervix. If the patient is stout, lateral retractors may be of advantage in giving more room and more light. In most cases the fingers of the left hand will be quite sufficient to expose the parts. In those cases where the cervix can be brought outside the vulva, retractors will not be necessary.

A scissors, curved on the flat, is made to cut through the mucous membrane around the cervix, at a distance well clear of the disease. As a general rule, it will be wise to carry this line as high up as possible, short of the limits of danger to bladder or ureters in front, or rectum behind. When the uterus has been much dragged down, the normal relations to bladder and rectum are disturbed; and if deep cuts are rashly made, these viscera may be wounded. (Fig. 69.) The finger moved over the cervix, and judging of the mobility of the mucous membrane covering it, will always be a reliable guide.

The mucous membrane is now elevated from the cervix,

connecting cellular tissue being divided by forefinger and scissors. A catch forceps placed on the anterior flap and handed to the assistant, who pulls it forward while he depresses the cervix with the volsella, will facilitate the dissection in front; while a reversed manipulation will be of equal advantage behind. Laterally, no cutting must be made after the mucous membrane is divided. The cellular tissue must be pushed up as high as possible by the finger without tearing it; frequently

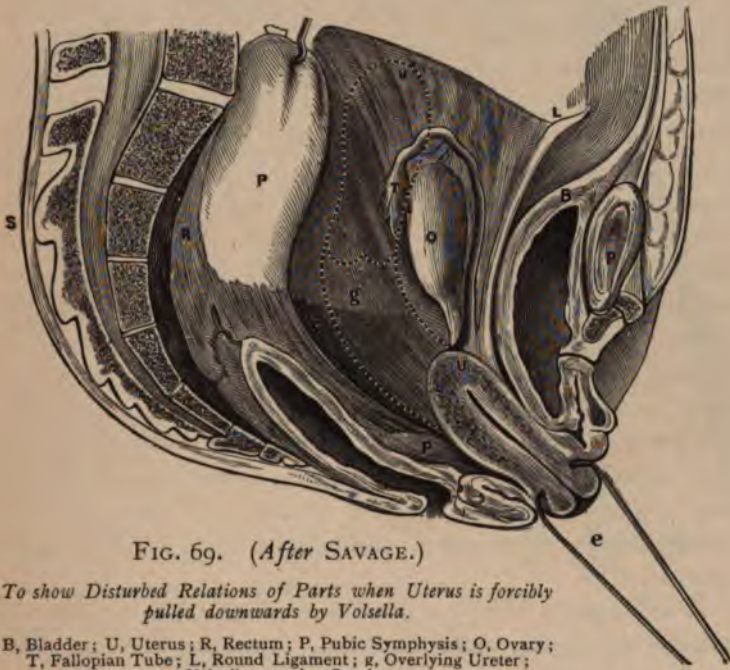


FIG. 69. (After SAVAGE.)

To show Disturbed Relations of Parts when Uterus is forcibly pulled downwards by Volsella.

B, Bladder; U, Uterus; R, Rectum; P, Pubic Symphysis; O, Ovary; T, Fallopian Tube; L, Round Ligament; g, Overlying Ureter; e, Volsella grasping Cervix.

the upward limit will be defined by a feeling of pulsation in the uterine arteries. Under all circumstances, in the dissection, it is a wise plan to keep close to the uterus.

A sound in the bladder is by many operators considered an assistance. If there is any doubt as to the position of that viscus, and any apprehension of its being injured, then the sound ought to be inserted. But if the rule to keep close

to the uterus is followed, and if the finger has been made familiar with the feel of the parts by practice on the cadaver, the sound will rarely be wanted. A wound accidentally made in the bladder must be at once sutured. Schmidt, in one operation, had the misfortune to cut away an inch of the ureter along with the uterus; he at once performed nephrectomy, and the patient recovered. A less severe operation would now probably be performed (*See "Surgery of Ureters"*).

Opening the Peritoneum.—When the mucous membrane has been cleared from the cervix as high up as the peritoneum, that membrane is perforated in front and behind, and the abdominal cavity is entered. The forefinger is the best perforator. Above the internal os the peritoneum is closely adherent to the uterus anteriorly and posteriorly, and here the finger may be pushed through it by a little judicious manipulation. If it is more than ordinarily tough, and it seems to be yielding and stretching in front of the finger, a Lister's sinus forceps sharply pushed through it will, after separation of the blades, make an opening large enough to admit the finger. The opening is enlarged in front and behind by tearing with the finger on both sides as far as the broad ligament. Braithwaite makes a great point of leaving the peritoneum behind intact till that membrane in front has been fully opened, hoping in this way to prevent access of blood, cancerous or septic matters. Before making the posterior opening the parts are thoroughly cleansed.

A soft sponge is now pushed through the opening into the posterior cul-de-sac, and left there. It serves to protect the bowels and keep them out of the way, while it absorbs any effused fluids and lies between the general cavity and any possible infection from the cancerous uterus.

Division of the Broad Ligaments.—The most difficult and delicate step in the whole proceeding is the separation of the uterus from the broad ligaments, and the securing of the vessels lying in them against bleeding. For this purpose an almost endless variety of plans has been devised. The ligaments have been

secured in mass by ecraseur, wire, silk, and elastic; they have been divided and seared by cautery; and they have been secured in separate divisions by loops, chain ligatures, and continuous sutures. To facilitate manipulation, the uterus has been turned upside down in backward and in forward direction, and it has been completely bisected from fundus to os. Minor varieties of these varieties have been recommended and carried out; as, for instance, the division after ligation of the lower portion of the broad ligaments; then turning the uterus upside down, and ligating and dividing the upper portions. One writer is of opinion that the Fallopian tube ought to have a catgut ligature of its own; and special needles are accredited with special virtues for the placing of ligatures.

The best results will be got from the selection of an efficient plan which is at the same time simple, and endeavouring to perfect it. The application of ligatures is often difficult; in the most skilled hands it has sometimes failed to check bleeding. The simplest plan is certainly that of temporary pressure by forceps or clamp, and it can undoubtedly be made efficient. A good deal of evidence in favour of this plan has appeared in the journals. Richelot of Paris, in particular, has devoted attention to the method with conspicuous success. Müller and Landau (71 operations, 5 deaths) strongly recommend the method, and many other operators speak favourably of it. I have for some time advocated this principle, and had devised a special clamp for the practical carrying of it out, some time before it was mentioned in the journals.

The instrument (Fig. 70) is simply a straight clamp with long



FIG. 70.

*The Author's Clamp for
Kolpo-Hysterectomy.
One-third size.*

and powerful handles, and grooves on its lateral aspect to guide a small knife which is intended to cut through the clamped ligaments. It is deeply slotted on its compressing aspect, to prevent slipping; elsewhere it is smooth and rounded. Through the posterior opening the forefinger is carried over the top of one broad ligament, hooking it down as far as possible. This manœuvre may be facilitated by a blunt hook, handed over to an assistant. The posterior blade is now carried upwards along the finger, at a distance of about half an inch from the uterus, and the end hooked over the top of the ligament. Its handle is pressed backwards on the perineum. The anterior blade is introduced in front of the ligament, parallel to the posterior blade, and its end is locked by a simple mechanism into the end of the posterior blade. The clamp is then closed, and the handles screwed up tightly outside the vulva. A second clamp is similarly applied on the opposite ligament. When both clamps are applied, the knife is run up the grooves and the ligaments divided on the uterine side of the clamps, when the uterus is freed. Or scissors may be used for this division. The instrument may be easily removed at the end of one or two days, when the natural process of vascular closure will provide against the occurrence of hæmorrhage. Mr. Knowsley Thornton has devised a modification of this clamp, in which the handles, attached by a bayonet joint, may be removed, and in which the grooves for the knife are done away with.

The use of these instruments renders the operation a very simple one. It is possible, in the deadhouse, to remove the uterus by means of them in five minutes, and leave the parts in a condition anatomically and surgically satisfactory; and on the operating table, the proceeding ought not to occupy more than half an hour.

The use of strong compression forceps, to be removed after one, two, or three days, would secure the same result with somewhat less facility and greater cumbersomeness. Müller* has advocated the use of two pairs of forceps, one pair to each

* *Centralbl. f. Gynäk.*, 1887, No. 12.

broad ligament, and supports his recommendation by records of five cases, with one death. Prof. Eastman, of Indianapolis,* places a pair of compression forceps on each broad ligament after it has been surrounded with a ligature, and pulls the forceps together so that they lie closely side by side. Pean's special



FIG. 71.

Jessett's Forceps for the Broad Ligaments in Hysterectomy.

forceps, long and slightly curved in the blades, are very suitable for the proceeding. Jessett's forceps (Fig. 71) are excellently designed for the purpose, and are perhaps the best of all. The disadvantages of the use of forceps are, that several pairs have to be applied, and left in the vagina, causing discomfort to the patient and setting up irritation in the parts.

A word of warning must be given as to the danger of leaving on pressure forceps or clamps too long. I lost a patient (the only one I have lost after this operation), from whom I had removed a sarcomatous uterus, through sloughing of the broad ligaments where they were compressed by forceps. The operation was not a difficult or prolonged one—it occupied about half an hour,—but the patient was very much reduced. The power of forceps or clamp is enormous, and pressure exerted by them for a very short time may cause necrosis. If they might be safely removed at the end of ten or fifteen hours, as I believe they might, this risk would be minimised. As one gets more experience and skill in the operation, one is more inclined to trust solely to ligatures. For one who is not accustomed to perform operations of this sort, the use of clamp or pressure-forceps is no doubt advisable.

In some cases where the uterus is considerably enlarged, as in malignant disease of the fundus, or as in a case on which I

* *Indiana Med. Journ.*, April, 1890.

operated where pregnancy co-existed, the tops of the broad ligament lie beyond the reach of the finger, and the whole structures are voluminous, the clamps are unsuitable, and either forci-pressure or deligation must be instituted. In the application of either method, I believe that turning the uterus upside down will be found an advantage: and this I should select in preference to all other methods which have been recommended. Complete rotation of the uterus on its long axis materially shortens the depth of the broad ligaments, brings them more fully within the field of operation, and leaves the most important stage of the proceeding—division of the uterine arteries—to the last, when it is also rendered most easy.

Against the plan of turning the uterus upside down it is urged that thereby a cancerous and perhaps foul mass is brought into contact with the peritoneum. To avoid this risk the super-added operation of excising the cervix has been recommended and performed. Now it is easy enough, by the use of germicides, to render the cervix for a short time practically aseptic, or even actively antiseptic. But all such risks may easily be avoided by the expedient, ordinary enough in abdominal surgery, of placing a sponge between the possibly noxious substance and the peritoneum.

It matters little whether the uterus is turned backwards or forwards. If rotation can be performed by the finger alone, it is most easily carried out in the forward direction, with the finger in the anterior opening and hooked over the fundus uteri. If the finger does not suffice, anterior rotation by means of forceps may be carried out. A firm hold of the anterior surface is taken with catch-forceps, and the uterus is pulled down as much as possible; a second hold is secured higher up, and so on, one above the other, till the fundus is grasped, and the uterus pulled down and completely inverted. The fundus now lies in the vagina, and perhaps presents at the vulva, and the upper insertions of the broad ligaments are within sight and reach.

Where it is possible to apply it properly, a satisfactory ligature is probably better than the best forci-pressure. With an inverted uterus, deligation of the broad ligaments presents no special difficulties,

and can be easily done by means of the ligature-placing forceps, or by special needles such as those of Jessett. (Figs. 72 and 73.) Braithwaite found that it was not necessary, in two successful cases, to place forceps on the uterine side of the divided tissues; bleeding was checked by the forcible traction on the uterus. In all the cases I have operated upon since reading this statement, I have placed neither ligature nor forceps on the uterine side of the divided ligament, and have found his statement borne out in practice. The ligament is simply transfixed at a suitable distance from the uterus, tied, and divided by scissors. Division is begun at the top; if possible the topmost ligature is made to go outside ovary and tube, so that these are removed with the uterus. But this is not of great importance. Two or three successive pieces of ligament are so treated, and one side of the uterus is set free. The other side is similarly treated, and the whole uterus is then removed. The broad ligaments are thus secured by three or four ligatures on each side, which are cut off short. If there is any doubt as to the security of the deligation at any points, catch forceps are placed on the visible vessels, and these are either ligatured subsequently, or the forceps are left hanging and removed next day or the day after.

Ovaries and Fallopian tubes, if they are healthy, need not be removed. The only reason for removing the appendages would be the prevention of morbid pains. In one patient on whom I



FIGS. 72 & 73.

*Jessett's Needles for placing ligatures
in the Broad Ligaments.*

operated, leaving ovaries and tubes, five years ago, backache at the menstrual period was very severe for some months. In another patient there was little or no trouble. After the menopause removal of the uterine appendages need never be performed.

When the uterus is pulled down, and particularly if it is inverted, the broad ligaments are stretched and tense. As soon as the uterus is cut off, the ligaments recoil, become flaccid, and retract, tending to cast ligatures loose. Therefore the ligatures should be tightly drawn, and they should have a considerable hold upon the tissues. These precautions ought to be specially observed in the lower portions of the ligaments, where the uterine arteries lie. And it must be remembered that it is here where the risk of wounding the ureters, or of including them in the ligatures, is greatest. These dangers are enhanced by inversion of the uterus. They are minimised by a thorough separation of surrounding cellular tissue in the early stages, and by keeping always as close to the uterus as possible.

The Peritoneal and Vaginal Wounds do not require suture. No better results are got from suture than from leaving them to fall into apposition, and unite as best they can. Some surgeons recommend that the peritoneum should be sutured to the vagina; others, that the vagina alone should be sutured; and others say that if the peritoneum is sutured, the vagina may be left to look after itself. But suturing of any sort has been proved to be unnecessary. I found, in a case where the drainage tube had slipped out of the peritoneal cavity about fifteen hours after operation, that the uniting adhesions at the top of the vagina were so strong that I could not, without using more force than I thought wise, reintroduce it. A positive objection to the employment of sutures, whereby flaps are kept in close apposition, is that the discharges which ooze from their surfaces are locked up and may become sources of septic infection. The parts fall naturally into apposition, and remain apposed. It is true that the best and quickest healing will be got if like tissue is apposed to like; and advantage ought to be taken of the remarkable rapidity with which inflamed serous surfaces cohere. Further, it is

advisable that all oozing from raw surfaces should find its way into the vagina, rather than into the peritoneum.

This end may be simply effected in the withdrawing of the sponge placed inside the abdomen through the opening. It pulls down the peritoneum with it, and in so doing leaves serous surfaces in contact and raw surfaces closed in, while it leaves the flaps so that discharges from them run into the vagina. The serous membranes first unite, and, as soon as they close, the peritoneal cavity is shut off. There is very little risk of prolapse of intestines.

Drainage of some sort is advisable for the first day or two. If the clamps are used, they will act as drains. If not, a glass drainage-tube of ordinary size and shape is as good as any. It should be placed very carefully, without disturbing the relations of the serous and mucous flaps. A T-shaped tube has the advantage that it will not slip out of the abdomen; but it has the disadvantage that it cannot be removed without breaking down recent adhesions.

For the first twenty-four hours sero-sanguinolent fluid will be discharged through the tube; thereafter, for a day or two, serous or sero-purulent fluids, in diminishing amount. At the end of three or four days, if all goes well, the tube may be removed.

In view of the fact that all fluids lying in Douglas's pouch have a tendency to undergo decomposition, and that in hysterectomy there may be actual entrance of air or vaginal secretions into the abdominal cavity, it will be a wise plan at stated intervals to irrigate through the drainage-tube. This may be easily done by passing a catheter attached to an irrigator along the drainage-tube to the abdominal cavity, and sending a stream of warm lotion through it. When the fluid returns clear, irrigation may be stopped.

A roll of antiseptic gauze or cotton passed up the drainage-tube will act as an antiseptic plug, and a capillary extractor of fluids. Plugging of the vagina is troublesome and unnecessary. If the tube is surrounded with antiseptic wool where it lies between the labia, and if the external parts are kept thoroughly clean and

sweet, there is little danger of septic infection. Indeed, it is notorious that tampons in the genital passages have of themselves a strong tendency to become putrid.

A good working method is to draw the urine through the catheter every five or six hours. When the bladder is emptied the wool surrounding the end of the drainage-tube is withdrawn, and the cavity is irrigated. Then the external parts are thoroughly cleansed; boro-glyceride is smeared all over them, and a new dressing is applied.

It has been recommended that the patient's shoulders should be raised, so as to permit of downward drainage. This is quite unnecessary; and it may be harmful by encouraging the access of air. The extensive experience of drainage through the anterior parietes has proved that intra-abdominal pressure is quite sufficient to force free fluids upwards through a patent opening; and to prevent the admission of air, it would be wiser to have the external end of the tube in the vagina on a higher level than the end in the abdominal cavity. But a plug of cotton wool, while encouraging the escape of fluid, will prevent the insufflation of air.

The general treatment requires no special description. The histories of recorded cases seem to show that there is more than the ordinary tendency to tympanites. The use of the rectum tube, the exhibition of turpentine enemas, and the administration of saline purges, will most efficiently remove this condition. In all respects the general management is similar to that after other abdominal operations.

Complications and Accidents.—Wounds of the bladder or ureter are much less frequent than might be expected. The bladder is most likely to be wounded during the early stages before the peritoneum is opened, and while the relations are disturbed by the uterus being dragged down. The best way to avoid the accident is to keep close to the uterus and to push the bladder forwards out of the way. If the bladder is wounded, it ought to be at once sutured.

Wound of the ureter is a more serious affair; its treatment

is considered further on. It is most likely to suffer injury at the end of the operation; and more particularly is it liable to be included in the lower ligatures applied to the broad ligament. Keeping close to the uterus is here also the best mode of avoiding the risk. But the accident very rarely happens.

Cases are recorded where intestinal fistula has been caused by pressure from the drainage-tube.

Hæmorrhage, either during or following the operation, is the chief risk. If the bleeding points cannot be included in ligatures, pressure-forceps are left attached. After the operation, if hæmorrhage takes place, a Ferguson's speculum must be passed and the source of the bleeding sought for. When discovered, the simplest method of checking it is to apply and leave on a compression forceps. For general oozing, a stream of water heated to 110° Fah. may be safely and advantageously passed over the bleeding surface.

The ordinary complications of operations in the pelvis may arise: such are—pelvi-peritonitis, phlebitis, lymphadenitis. They are to be treated on ordinary principles.

Hysterectomy for Intractable Inversion.

With the help of the admirable repositories of Aveling and others, it now rarely happens that an inverted uterus cannot be replaced. But it does sometimes happen that, in spite of the most skilled and patient trials, an inversion cannot be cured, while the resulting condition to the patient is so grave that a means of cure is urgently demanded. Under such circumstances hysterectomy may be called for.

History.—Paulus Ægineta speaks of the removal of a prolapsed uterus which had mortified as having been carried out with success. But this probably was merely the removal of a sloughing polypus. In 1678 Arnould excised an inverted uterus, with fatal result. Deleurye, Assilini, de Bardol, Beaufils, Faivre, Hunter, and others, have operated by ligature, mostly without success. At the end of the eighteenth century Baudelocque made an elaborate study of the treatment of uterine inversions, and formulated some very sensible conclusions. He clearly differentiated between an extruded polypus and an inverted uterus, and laid down definite rules for diagnosis and treatment. In recent times, Denucé* has been conspicuous in advancing our knowledge of the subject.

The *diagnosis* of complete uterine inversion is sufficiently easy. It can be mistaken only for a polypus. Conjoined manipulation, under anæsthesia if necessary, will show the presence of the uterus in its normal position in polypus, and its absence in inversion. The finger in the rectum may further detect the funnel-shaped depression into which the round ligaments and Fallopian tubes pass, and in which occasionally the uterine appendages may be detected. Pulling down the uterus aids the diagnosis in those points. The absence of os uteri, the continuity of the tumour with the uterine cervix at every point, and occasionally the presence of the two small openings

* *Traité de l'Inversion Uterine.*

at the cornua leading into the Fallopian tubes, will be determined. Polypus may be associated with inversion: here extra care must be observed.

THE OPERATION.

A good many methods of removing the inverted uterus have been employed. They may be classified under three heads:

- (1) Immediate removal, at one sitting.
- (2) Gradual removal, by compression or cautery.
- (3) Excision and compression combined.

Immediate removal has been performed by a simple cutting operation, by crushing with ecraseur, and by the actual cautery. Velpeau is credited with a success after excision. McClintock, Sims, Denucé, and others, have had successes with the ecraseur. Ligature, immediately followed by excision, and searing of the raw surface after excision, has also been employed more than once with success.

But no method of immediate removal has had favourable results: according to Schroeder, a 57 per cent. mortality may be expected. The objection to this method is the very serious one, that it leaves the peritoneum exposed to infection from the traumatic and suppurative processes induced in the stump. Even if adhesions form after deligation or charring, they are too flimsy to act as an efficient barrier to the entrance of septic products.

Gradual removal by sloughing, induced by compression or cautery, has had better results. Of all methods of gradual compression, the elastic ligature has been found most successful. Courty has had a few successes by the use of the galvano-cautery, applied slowly and at several sittings. The ecraseur and the wire serre-nœud have been used in this way also.

But here also the mortality has been high—27 per cent. And gradual strangulation causes severe pain, and frequently begets serious nervous disturbance—sometimes even alarming

collapse. The presence of a large sloughing mass in the vagina is neither agreeable nor free from danger.

Compression and excision combined have given the best results—17 per cent. mortality. The principle of the proceeding is, to keep up compression for a few days, till strong adhesions have formed on and around the inner serous surfaces, and then to amputate the uterus below the site of constriction. This is the plan recommended by Schroeder, and successfully modified by Pouissot, Despres, and more recently by Schülein.

The constricting agent may be a simple ligature of silk or catgut; or an elastic ligature, prevented from slipping by previously charring a circle of tissue with the galvanic cautery; or an ecraseur, such as that of Cintrat or Koeberlé. As simple and efficient as any is the application of a strong ligature of silk, and the superimposition of an elastic ligature in the groove thus made. The silk ligature, pulled very tightly, fixes and steadies the underlying tissues; the elastic keeps up a continuous pressure on the receding tissues after the silk ligature gets loose; and, at the end of three or four days, closure of vessels and adhesion of peritoneal surfaces may be confidently expected.

The uterus will have been well soaked in glycerine of carbolic acid, or some similar antiseptic that will penetrate its tissue. In spite of this, a gangrenous odour will usually appear in a few days. On the third day, or later according to the behaviour of the strangulated uterus, amputation may be performed. This operation must be carried out with as little disturbance of parts as possible. A series of cuts with scissors whose blades are at right angles to the handles, and whose movements are guided by a finger in the vagina, would fulfil this requisite. The section is to be made close to the ligature, so as to completely remove all tissue which is, or is likely to become, necrosed. A cylindrical speculum cautiously introduced into the vagina will afford a good view of the stump left. If it seems healthy and compact, the ligatures may be removed and the raw surface smeared with an antiseptic. The vagina is then thoroughly cleansed and kept clean, and the stump is left to its fate.

Hysterectomy for Myoma.

Perhaps "Removal of Uterine Myoma by Cœliotomy" would be a better name than the above for the operation to be described. In some cases, it is possible to remove the growth without removing any part of the uterus; in others, a part of the uterus may be removed, while the uterine cavity is not entered; while, in a third class, the uterine cavity is entered, and varying amounts of its structure removed, up to complete hysterectomy. But, as the operation is very generally known by the name given, it is here adopted.

History.—Lizars in 1825, and Dieffenbach in 1826, encountered uterine myoma on opening the abdomen; but neither endeavoured to remove the growth.

In 1837 Granville is said to have unsuccessfully removed a pedunculated uterine fibroid. In 1843 Heath operated unsuccessfully, and in 1844 Clay of Manchester operated with like result. Burnham, an American, is credited with the first success, in 1853; and in 1855 Kimball, another American, had a success. Péan, Hegar, Billroth, Kaltenbach, and Schroeder, on the Continent, did much to advance the position of the operation; in our own country, Keith, Bantock, Tait, Thornton, and others, have been conspicuous among operators and teachers. For magnitude of operations, perfection of methods, and brilliancy of results, Keith holds a commanding position among all operators.

Mortality and Appreciation.—It is impossible so to present the statistics of hysterectomy for fibroids as to give a fair idea of the results which may be fairly expected to-day. Thus, Bigelow,* in a total of 573 cases, gives 311 recoveries and 241 deaths—the results in some not being recorded. Vautrin,† in his valuable monograph, classifies operations for myoma as—myo-

* *Amer. Journ. Obst.*, Nov. 1883, *et seq.*

† *Du Traitement Chirurgical des Myomes Uterines*, Paris, 1886.

mectomies, or simple removal of a subserous myoma; enucleations; partial amputations of the uterus; and complete supra-vaginal hysterectomies. He gives tabular descriptions of operations under each head. In 32 myomectomies there were 24 recoveries; in 23 enucleations there were only 9 recoveries; in 36 partial amputations there were 26 recoveries; and in 82 supra-vaginal amputations there were 44 recoveries.

Gusserow's statistics, comprising 359 cases operated upon between the years 1878 and 1885, give 237 recoveries and 122 deaths—a mortality of 33.9 per cent. If to these are added 180 cases operated upon by Schroeder, Olshausen, Braun, and Tauffer, we get a total of 539 cases, with a 30 per cent. mortality.

The general mortality in the last few years is nothing like so great as this; and in the hands of a few operators it does not exceed 15 per cent. Keith's mortality, in most unpromising cases, is only 8 per cent.; Tait's mortality, in his latest cases, is very low; and Bantock and Thornton are getting results equally good. I have had a series of 41 operations without a death; and 48 with two deaths. One of the fatal cases had pleurisy at the time of operation, and her tumour weighed in solid 89 pounds; the operation was done as a last resort; the pleurisy was fatal. The other death occurred after the patient was getting up with healed wound, of some heart trouble, about a month after operation. On the Continent, half-a-dozen operators could be named whose mortality is under 15 per cent. Into the further details of the abundant statistics it is not necessary to go. It is clear that, in the hands of properly qualified operators, the proceeding, from the point of view of immediate mortality, is as justifiable as any other major operation.

A further and more important consideration is whether, with a death-rate even of one in ten, the operation is ever justifiable. It is urged by several writers that uterine myoma is not a fatal disease; that palliative treatment will always tide the patient over periods of danger, and often effect a cure; that the life-history of the disease is limited; and that a death-rate of even five per cent. absolutely forbids surgical operation. On the

other hand, it is urged that myoma is often fatal; that, in many cases, medicinal treatment is utterly futile; that a considerable number of cases go on causing danger or serious trouble long after the usual period for menopause; and that, in a selected series of cases, the operation is not only justifiable but necessary. It would be tedious and useless here to go over the often repeated arguments for and against the operation. As usual, the safe course is the middle one.

Indications for Operation.—The actual indications for and against operation are not easily specified in general terms. The aggregate amount of evil that a given tumour produces, the summation of the varied symptoms, must be taken into account in coming to a definite conclusion. And some weight must be given to the patient's position in life and her home surroundings. A condition of chronic invalidism may be scarcely a hardship in one class in life; while in another it may mean domestic disruption or positive misery. One woman may passively submit to the disablement, or prefer to put up with it rather than incur the risk of operation; while another may actively rebel and cry out for relief at any cost. All such conditions must be carefully and honestly weighed, and their influence reckoned in coming to a decision.

Concrete and specific indications may be sought under the following heads. Their weight is more often from a summation of several than from a consideration of one. But one indication in extreme may suffice when the whole in moderation may not:—

1. *Size of Tumour.*—Mere bulk may be an indication for operation. A fibroid weighing over thirty pounds condemns the individual to invalidism; a tumour extending upwards under the ribs, even if it weighs no more than twenty pounds, renders living to the average individual a burden. A large tumour in a young woman more urgently calls for removal than in an old woman, for it will probably go on growing. Any tumour weighing over twenty pounds should be removed, unless the menopause

is close. Of course it is taken for granted that the surgeon is able with some degree of accuracy to estimate bulk.

2. *Rapidity of Growth.*—Rapidity of growth is an indication for removal because, clinically, it is generally found that the tumours which grow most quickly get largest. In a young woman a growth that has risen above the umbilicus in six months from its first appearance should be operated upon, provided all other measures have failed to check its growth. In a woman near the menopause we may wait; for such growths often take on active growth at this period, and cease growing afterwards. But if, after the menopause, growth continues, and shows no symptoms of ceasing, operation should be performed. Tumours which appear after the menopause do not often grow quickly, although there are striking exceptions to this rule.

3. *Development of Cysts.*—Cysts are most liable to develop in the soft œdematous myoma; and this is the variety of tumour which reaches the largest dimensions. In a general way it may be taken as a clear indication for operation when cysts appear in the tumour. Their occurrence is the beginning of a pathological change which will probably spread through the whole tumour, and ultimately render operation necessary. It is wise therefore to seize the first opportunity for removal after the diagnosis of cyst-formation is clear.

4. *Suppuration and Sloughing.*—Operation must follow either of these conditions, but such operation need not always mean removal of the whole growth. Retrogressive changes resulting in necrosis and formation of abscess may be the beginning of a natural atrophy. If therefore an abscess can be evacuated, or a slough removed, and the cavity satisfactorily drained, the surgeon may be content to do this and wait. Sloughing of the whole tumour, or of the greater part of it, is perhaps best dealt with by removal. Sloughing with extrusion through the os into the vagina (the most common condition) is usually best treated by removal of the slough, and irrigation. If there is reason to believe that the necrosis extends to the peritoneal envelope,

complete removal by abdominal section probably gives the best chance of cure.

5. *Metrorrhagia*.—Excessive metrorrhagia which every palliative measure fails to check is an indication for operation. In small tumours removal of the appendages may be selected; where this is impossible, or where the tumour is large, removal should be performed. In one patient there may be constant dribbling of small quantities of blood; in another, infrequent but excessive loss of blood over a few hours; and there is a great variety between these extremes. The amount of permanent anæmia induced, with the accompanying subjective symptoms, must be our chief guide. When it is clear that the patient does not, between the bleedings, make up the ground lost, and is from month to month losing ground, operation should be decided on. Proximity of menopause should make us delay operation as long as possible.

6. *Pressure on Viscera*.—Obstruction of bowels from pressure by the tumour is an indication for removal. This pressure may be from a small tumour jammed in the true pelvis and pressing on the rectum; or it may be from a large tumour pressing on the sigmoid flexure or descending colon. Almost never can a jammed fibroid be pushed into the abdomen; it is fixed by shortness of attachment, or it is growing between the layers of the broad ligament, otherwise it would probably have risen upwards of its own accord. I have had to operate on three cases of fibroid in which intestinal obstruction were present. Pressure on the bladder may give rise to much discomfort, but rarely to risk. Pressure on the iliac veins may produce great œdema of the lower limbs; and venous thrombosis has thereby been induced. This also indicates operation.

7. *Pain*.—Severe pain is sometimes present, either directly from the tumour itself or indirectly from pressure on nerves and shooting down the limbs. Small hard tumours in old women seem to cause most pain; and in them indications for operation are, on other grounds, least strong. Severe neuralgic pains extending along the anterior crural nerve may, if they persist, be

taken as indicating removal of growth. But in every case of pain it should be borne in mind that a chance movement of the tumour, or a local increase of growth raising the tumour away from the nerve, may give relief. I have thought that calcification is often associated with pain.

8. *Ascites*.—The presence of abundant ascitic fluid is a strong indication for operation. One or two tapplings may be performed; if it re-accumulates the growth should be removed. If the fluid removed is blood-stained, this suggests that the growth is malignant, or becoming so; and it should be at once removed. Although there are doubtless exceptions to this rule, I have never seen a case of blood-stained ascitic fluid without malignancy in the solid tumour which caused it. A small quantity of ascitic fluid is present in most cases, and means nothing.

These are distinct indications for the performance of hysterectomy, the operation being begun with the view of finishing it as such. Another indication may be given as follows: An operation is begun with the view of removing the uterine appendages; this is found impracticable, and an examination reveals that myomectomy or hysterectomy may be performed without undue risk: in such a case the major operation may be proceeded with. One indication for operation is vaguely put down as "when other measures have failed." These measures refer to the ordinary medicinal methods of treatment, and to the special treatment by Apostoli's electrical method. What value is to be placed on such methods it is very difficult to estimate. In most cases the appeal to the operating surgeon is the ultimate one; other measures have been exhausted before the patient seeks operation. Of the value of Apostoli's treatment I am not competent from personal experience to give an opinion. Of this I am certain, that if it diminishes the number of cases requiring operation, it does not by any means remove all cases from the necessity of operation. A considerable proportion of the cases which I have had to operate upon have been submitted to Apostoli's treatment by competent men without advantage. And this is as far as I can go in speaking of the treatment.

Symptoms and Diagnosis of Uterine Myoma.—The well-known classification of uterine fibroids into interstitial, sub-mucous, and sub-peritoneal sufficiently indicates the position which such growths may occupy with regard to the uterine walls. With regard to the region in which they lie, they are spoken of as fibroids of the fundus, the body, or the cervix. They are most frequently globular in shape, especially when they are not of large size; but they may assume most irregular, even grotesque, forms. In size, they vary from that of a pea to dimensions as great as the capacity of the abdomen. They are of hard dense texture, cutting with a peculiar gritty sensation, and exhibit a dull white or glistening surface on section, which has been likened to mother-of-pearl. Frequently they contain cysts in their substance, and occasionally they are soft, œdematous, almost fluctuating. Often they are traversed by enormous vascular channels.

A developed fibroma may be said to live outside the uterine fibre, even when it is encapsuled in its substance. Courty well describes it as parasitic; sometimes its nutrition may be said to be carried on by imbibition. In such cases the fibroid is completely encapsuled, lying in a bed of loose cellular tissue, and may be enucleated like a foreign body. These tumours are liable to undergo changes in structure. After inflammation they may become very dense, being little else than a mass of fibrous tissue with scanty muscular elements; and this fibrous tissue may undergo general or peripheric calcification. They may become fatty, and undergo liquefaction with the formation of cystic cavities. Occasionally they suppurate, or even become gangrenous. Cancerous and sarcomatous degeneration or invasion are described as sometimes occurring: I have had one example of sarcoma in my own practice. Finally they may undergo regressive involution, and completely disappear. It is generally observed that uterine fibroids increase in size during pregnancy.

The first sign is usually metrorrhagia. At first the excess of bleeding occurs only during the normal period; then it comes on in the intervals as well; and in the worst cases there is a continuous discharge of blood, in varying quantities, at all times.

The blood is frequently discharged in clots of considerable magnitude. Pains of a down-bearing expulsive character, and shooting across the hips and down the thighs, with feelings of weight or pressure inside the pelvis, and dragging sensations in the loins, are frequently complained of. In the intervals of bleeding, a glairy, semi-purulent fluid is discharged. Symptoms of mechanical pressure on the pelvic organs, such as dysuria, excessive frequency of micturition, constipation, or diarrhoea are frequently observed.

The physical signs vary according to the size of the tumour and its situation in relation to the uterus and the abdominal cavity. Through the parietes a tumour is felt arising out of the pelvis—hard and incompressible in most instances; occasionally soft or even fluctuating; usually rounded and smooth all over, but not infrequently covered with bosses; movable from side to side, if it does not fill the abdominal cavity, and moving in company with the uterus as felt through the vagina. Absolute continuity of uterus and tumour may be made out by vaginal and rectal palpation. The uterine sound will show enlargement of the cavity, with some deviation in its direction. From being a simple canal some two or three inches in length, the uterine cavity may be elongated and spread out into a flat fan-shaped space in which the sound can be freely moved from side to side. In some cases, where the growth lies on one side and is mainly extra-mural, the uterus is forcibly pushed over to the other side. This lateral version of the uterus is often described as being a valuable presumptive sign of myoma. In other cases the uterus is dragged upwards into the abdomen, or pushed downwards on the perineum, according to the direction in which the tumour grows from its seat of attachment.

Interstitial fibroids cause general hypertrophy of the uterine walls, with vascular engorgement of the mucosa. Located in the fundus, they may, when small, cause marked version or flexion; when large, they produce displacements—upward, downward, and lateral—of the most varied description.

Sub-mucous fibroids may often be felt through a softened and dilated cervix. Their tendency to become polypoid and to

be extruded by uterine action is well known. They set up great irritation of the uterine mucous membrane, causing much muco-purulent and sanguineous discharge. The uterine cavity is at the same time dilated and encroached upon; the uterine wall on the side opposite the growth is spread over it and in close contact with it. These signs can be made out only with the help of the uterine sound.

Sub-peritoneal fibroids tend, at an early stage, to rise upwards into the abdominal cavity. There may be little change in the uterus as regards either shape or position: there is usually, however, some uterine enlargement as well as displacement, which may be found to vary at different examinations. Sub-peritoneal growths, if multiple, are usually small; if single, they are rarely larger than a child's head. They are freely movable, and the associated movements of the uterus may be not more marked than in ovarian tumours. Sometimes their pedicles are as long as two or three inches; and cases have been recorded where their connection with the uterus has been completely severed, and they have lived either through the vessels in adventitious adhesions or by imbibition from the peritoneum. Their symptoms are rarely urgent; often, there is little beyond discomfort and metrorrhagia to complain of. Hardness is said to be a characteristic of sub-peritoneal fibroids.

THE OPERATION.

The nature of the operation for uterine myoma will vary according to the situation and attachments of the tumour. The varieties of operation have been classified by Vautrin* as follows:

1. For the removal of sub-peritoneal, pedunculated myomata—*simple myomectomy*.
2. For the removal of certain tumours encapsuled in uterine tissue—*enucleation*.

* *Du Traitement Chirurgical des Myomes Utérlines*, Paris, 1886, p. 124.

3. For the removal of tumours incorporated in the uterine tissue, in which it is impossible to remove the growth without opening the uterine cavity—*partial amputation of the uterus*.

4. For the removal of tumours with extirpation of the uterus above the insertion of the vagina—*supra-vaginal amputation of the uterus*.

5. For the removal of multiple myomata with enlargement of the uterus, in certain cases—*complete extirpation of the uterus*.

This classification—simple, natural, and consistent with the pathology as it is—does not fully satisfy practical requirements. Thus, no distinct line can be drawn between partial and supra-vaginal amputation of the uterus. Complete extirpation—that is, removal of every particle of uterine tissue, leaving the vagina and the broad ligaments only as pedicle—may be regarded as an extension or completion of partial amputation, or amputation through the cervix, so that a separate description is not necessary. Indeed, from a practical point of view, a classification of operations depending on whether or not the growth extends between and opens up the layers of the broad ligament would probably be of more practical value than that of Vautrin.

The operations for uterine myoma are here described as:

1. *Simple myomectomy* or removal of the tumour without any of the uterine tissue, by excision or by enucleation, and without entering the uterine cavity.

2. *Hysterectomy*, total or partial; or removal with the tumour of more or less, or all, of the uterine tissue proper—usually, with entrance of the cavity.

This subdivision broadly corresponds to the all-important one of pedicle and no pedicle, and, still more broadly, to intra-peritoneal or extra-peritoneal completion of the operation.

It may truly be said of the operation for myoma, that the exact mode of operating can never be decided upon till the abdomen is opened and the condition ascertained by digital examination. In cases of small growths which are not pedunculated, removal of the uterine appendages may be indicated;

then the major operation is not called for. In cases of simple pedunculated sub-peritoneal growth, ligation of the pedicle and removal of the growth may be sufficient. Again: other growths, encapsuled and lying near to the uterine surface, may be properly treated by enucleation. But, in the majority of instances which call for removal of the tumour, a complicated operation, involving delicate and difficult proceedings to separate the mass from the bladder or to enucleate it from the broad ligaments, will be necessary. The operative details are schemed out after inspection; they are finally determined upon after the tumour has been turned out, and are frequently modified as the operation goes on.

Myomectomy.

The incision is made in the middle line below the umbilicus, and is long enough to admit the whole hand. The lower end of the incision should not approach the pubes too closely, as the bladder in these cases is often elevated. It is often found that the parietes are abnormally vascular in cases of uterine myoma. A complete examination of the mass is then made by the hand carried through the opening, and the advisability



FIG. 74.

*Tail's Screw for Myoma.
Half size.*



FIG. 75.

*Author's Myoma Screw.
Half size.*

of removal is decided upon. The incision is prolonged upwards with scissors, guided by the forefinger, as far as is necessary for delivering the tumour without bruising the edges of the wound. In the delivery and handling of these tumours the employment of a large screw, inserted into the tumour substance as

suggested by Tait, is of great assistance. Tait's screw, large as it is, sometimes slips if great traction is made on it. I have had one made of simple spiral form, much larger in its grasp, which can scarcely slip. (Fig. 75.) Two or three such screws placed some distance apart may be found invaluable in the dislodgment of an impacted tumour. When the tumour is removed from the abdomen, large sponges are packed inside the cavity to keep the bowels in place and to absorb extravasated blood.

Adhesions to the parietes must be separated before the tumour can be delivered, or during its delivery. As the tumour is being pulled out, great caution is necessary to make certain that adherent bowel is not torn; and with this object, the hand is placed inside the abdomen, under the tumour, to ascertain that undue traction is not being exerted on attached organs. Parietal adhesions may usually be severed by the fingers. Adhesions to bowel, omentum, or other organs, are divided between pairs of catch-forceps or double ligatures. Vessels in the omentum sometimes attain to enormous dimensions, and require great care in their division and ligation. If their walls are very thin, seeming scarcely strong enough to carry a ligature, the vessels must be followed upwards till a sufficient bulk of omental tissue to form soft packing around their walls is met with; and here the vessels are tied along with some of the surrounding tissue. As Thornton points out, much blood may be lost by dividing vessels coming from solid vascular tumours; such vessels do not contract on division, as they do in adhesions attached to an empty and contracted ovarian cyst-wall.

Pedunculated sub-peritoneal growths are removed after securing the pedicle. The mode of treating the pedicle will depend on its thickness, length, and vascularity. In some cases a simple ligature will be sufficient. Kaltenbach, Olshausen, Billroth, and others, have related cases in which simple ligation *en masse* has proved efficient. I have successfully removed a sub-peritoneal myoma as large as a child's head in which the pedicle was secured by a simple silk ligature, gradually tightened while the tumour was being cut away. If the pedicle is short,

this plan of coaxing tissue off the tumour by successive snips of a scissors while the ligature is tightened on the relaxed and isolated fibres is an excellent one; certainly better than simple deligation, followed by amputation. The tissues may always be drawn together more closely after amputation than before; and by this process of gradual constriction, combined with piecemeal amputation, all the vessels are caught in the ligature, and there is no likelihood of their recoiling afterwards.

In other cases the pedicle is too large to be safely included in one ligature, and here it is necessary to transfix. A blunt needle which will not wound a vessel is used, and it is inserted at a convenient distance between uterus and tumour, not too close to either. Thornton first ties in mass, and then transfixes and ties doubly beyond the single ligature. The Staffordshire knot may be used—supplemented, if necessary, by a second simple ligature. In fact, the mode of ligation must depend on the nature of the pedicle; and many efficient modes are available. The use of strong crushing or clamp forceps to diminish the bulk of the pedicle has its disadvantages as well as its advantages. If the pedicle is a broad one, the outlying vessels may be torn through by the strong compressing blades, and escape from their grasp, while only the vessels in the centre are caught. Olshausen* has laid down directions as to the mode of ligation, depending on the thickness of the pedicle. But points of equal importance are—its length, its density, and its vascularity. A thick pedicle which is long and compressible may be efficiently secured in a single ligature, when a less thick one which is short and dense may require multiple deligation. No definite rules can be laid down: the surgeon must be guided by general principles.

Gusserow† and others have been able to secure the vessels separately; and where this can be done, it is undoubtedly the best plan. A separate ligature to each vessel produces a hæmostasis which is independent of retraction of vessels or shrinking of uterine fibre. This plan can be adopted only where the pedicle is not large and where the vessels are not numerous.

* *Deutsche Zeitschr. f. Chir.*, Dec. 1881, p. 171.

† *Die Neubildungen des Uterus*, Stuggt., 1886, p. 103.

The elastic ligature is favoured by some surgeons, particularly of the French school. Its advantages are more conspicuous in cases where some considerable bulk of uterine fibre is included in the ligature; that is to say, in cases where atrophy and shrinking of the pedicle are likely to follow operation.

When the pedicle has been efficiently secured, its peritoneal margins may be drawn over the divided surface by means of a continuous suture. This diminishes the area of exposed raw surface, which is liable to become adherent to contiguous intestine, and so lessens the risk of danger from intestinal obstruction. Uterine stumps do not become quiescent so quickly as ovarian stumps: this is another reason for taking every precaution against their begetting trouble.

The pedicle, in myomectomy for sub-peritoneal growths, is dropped inside the abdomen, as in ovariectomy. In a few cases the extra-peritoneal method has been adopted; but such a course is justifiable only on the proved impossibility of treating the pedicle otherwise. Dragging on, with sloughing in the contiguity of, a uterus which is enlarged and sensitive from the presence of a myoma cannot be other than dangerous. The clamp and extra-peritoneal treatment of the pedicle in myomectomy for sub-peritoneal growths, is likely to be more disastrous even than in ovariectomy.

Enucleation is available in certain cases of myoma where the growth lies near to the uterine surface, and is evidently encapsuled. Spiegelberg* is said to have first practised enucleation with suture of the uterine wound. Martin, Billroth, Hegar and Kaltenbach, and others, have used the method, with not very encouraging success. Schroeder† identified himself with the practice of enucleation of fibroids, and obtained fair results; but other surgeons have not been prone to follow his example.

Before commencing enucleation, an elastic or rope temporary ligature should be carried round the body of the uterus below the fibroid to be enucleated. Incisions are then made

* *Archiv. f. Gynäk.* Bd. iv., p. 340.

† *Krankheiten der Weibl. Sex. Org.*, Leipzig, 1884.

through its capsule, circular or **V**-shaped according to the degree of bulging, and arranged so as to leave flaps which, when approximated, will completely overlap the bed from which the growth is enucleated. If the flaps do not fit accurately, they are trimmed down. Rows of buried sutures are placed from the bottom of the wound upwards, in succession, completely approximating the sides of the wound; finally the peritoneal surfaces are approximated by a row of superficial sutures.

Theoretically, this operation of enucleation is admissible; but practically, its mortality is high. In the hands of Schroeder himself, its chief advocate, 18 operations were followed by 11 deaths—chiefly from hæmorrhage and peritonitis; and the results of other surgeons are just as bad. The great risk is that, when the inevitable uterine contraction takes place, hæmorrhage may set in; the almost equally great danger of peritonitis would seem to be favoured by the inclusion of discharges under pressure in the uterine wound. It may be taken as practically true, that it is not safe to leave a wound through hypertrophied uterine tissue with no more perfect guard against hæmorrhage than a non-contractile ligature, which constricts uterine fibre as well as vessels; and even less safe to leave hæmostasis to the mercy of mere compression by flaps sutured over the wound.

Hystero-Myomectomy. Hysterectomy for Myoma.

In no abdominal operation is there a greater variety of method than in this for the removal of uterine myoma. The nature of the disease, endlessly varied as it is, is one reason for this; in the hands of the best surgeons two operations can rarely be alike. But variation in the method of operation has altogether outrun variety in disease. At least twenty different methods are described by as many surgeons, and permutations and combinations of these are put forward with a freedom which is truly bewildering. To describe all these varieties of operation is simply out of the question. To ascribe to the original author of it every improvement which has crept into the operation is a task probably beyond the powers of the keenest and most honest student of its history. I shall attempt neither task, but shall simply describe the operation which personal experience and study have taught me to adopt.

Hysterectomy is spoken of as total and as partial. Some surgeons call it total hysterectomy if the cervix, or even part of the uterus with the cervix is left. Here total hysterectomy is taken as meaning complete removal of uterus and cervix along with the tumour.

A further division is made, according as the pedicle is treated outside or inside the peritoneal cavity, into extra-peritoneal and intra-peritoneal. The operation is usually begun with the deliberate intention of finishing it according to one or other of these methods. Now, for reasons which will be given in full further on, I hold that the best surgery does not adopt one method to the exclusion of the other; but that one method is better for one case, and the other for another. The time for making the decision is when the tumour is cut off. Up to this point all operations are, on the main lines, similar. And so one description will suffice up to the treatment of the pedicle.

To prevent misunderstanding, it may here be premised that I hold that no intra-peritoneal treatment of the pedicle is good which leaves free inside the abdomen any portion of uterine tissue. The

reasons for this will be given when the treatment of the pedicle is discussed. Here, for the sake of convenience, it is simply stated that if any part of uterine tissue is left behind in the pedicle, this pedicle is to be treated either outside the cavity, or if inside, under and fixed to the parietal wound. Free intra-peritoneal treatment of the pedicle is recommended only if all uterine tissue is removed; in other words, if there is no pedicle but the vagina and the broad ligaments.

Instruments.—The ordinary cutting instruments may be conveniently supplemented by a large scalpel for amputating the tumour. A dozen pairs of small forceps, half-a-dozen medium-sized forceps, and the same number of large forceps should be provided. Of conspicuous advantage in dealing with broad areas of vascular tissue will be found the large forceps (Fig. 76), made on the plan described in the section on operations generally. They readily grip the slippery tissues; and they cannot slip, in whatever direction they are pulled upon.

* At least four such forceps, straight and bent, should be in readiness; six or even more should be provided for cases of very large tumours.

Two trustworthy clamps for constriction of the pedicle should be provided. Koeberlé's *serre-nœud* is best known and perfectly efficient. (Fig. 77.) Tait has modified this instrument in a manner which permits more rapid and easy fixation of the wire without interfering with its simplicity

and efficiency. (Fig. 78.) In Tait's modification the wires are simply placed in re-curved V-shaped claws, which bite the more



FIG. 76.

*Author's Large Pressure
Forceps; useful in clamping
Broad Ligaments.*

firmly as traction is increased. In Koeberlé's original instrument one end of the wire is formed into a loop, which is placed over the button; the other end is fixed by twisting or winding over



FIG. 77.

*Koeberlé's Serve-Naud.
Half size.*



FIG. 78.

*Tait's Modification of
Koeberlé's Serve-Naud.
Half size.*

the button or bar. An excellent clamp is Elder's (Fig. 79) "endless wire" attachment. Any one of these varieties of clamp will suffice. Two at least should be in readiness.

For use in the clamps a sufficiency of metal wire should be in readiness, in addition to that fixed in the clamps. Aluminium wire is, I think, the best. It is very pliable, and, if sufficiently thick, has quite enough tensile power. Next to aluminium, "Delta" metal is the best. In addition to the wire for the clamps, an abundance of the thickest silk ligature should be ready. Ordinary silk for ligation of vessels, and catgut, ox-aorta or kangaroo tendon for buried sutures should also be provided.

Some form of instrument for temporary compression of the pedicle during manipulation, and before placing the clamp in position, will be found of great assistance. Tait's temporary rope-compressor (Fig. 80) seems to be the most convenient of these

instruments. Pozzi's elastic tourniquet (Fig. 81), with self-acting grip, is an excellent instrument for temporary compression:

but its action is not so rapid nor so powerful as Tait's; and it is open to the objection, which may be urged against all elastic ligatures, that it is liable to slip over the stump when the tumour is cut off. The rope texture in Tait's instrument is preventive against slipping.

Other instruments are—myoma-screws (Figs. 74 and 75), of which there should be two or three; strong pedicle needles with handles and blunt points; a pedicle forceps and needles for transfixing and holding the pedicle outside the abdominal cavity—"pedicle-skewers," as they are called. (Fig. 82).



FIG. 79.

*Elder's "Endless Wire"
Clamp.*

A few more special instruments will be required, according to the method of treating the pedicle which is followed. These will be specially described under each special method or modification.

Position of Patient.—The posture of Trendelenberg, with pelvis elevated and head low, is favoured by many surgeons. I have already admitted that I have not been strongly impressed with the advantages of



FIG. 80.

*Tait's Temporary
Rope-Compressor.
Half size.*

this posture; but it is possible that the cases have not been suitable to show its virtues. The intestines are supposed to gravitate upwards away from the field of operation, and the tumour by its weight drags on its pelvic attachments and brings them nearer to the surface. The disadvantages which have struck me are, that the heavy tumour lying on the parietes presses too much on the bowels, and prevents our seeing them if they extrude; while traction on the pedicle if the tumour is of fair size—say, twenty pounds—is altogether too great. The chief disadvantage, I think, is that work behind the tumour, the most important part, is cramped and difficult, even if the tumour is held up. The advantages of the Trendelenberg posture would, I fancy, be greater in small tumours growing from the fundus, and least in large tumours opening up the broad ligaments.



FIG. 81.
*Pozzi's Elastic
Tourniquet.*

I prefer to have the patient in the ordinary supine posture with the pelvis lowered, and to turn the tumour downwards, letting it rest on the macintosh over the thighs. Protrusion of bowels is prevented by the insertion of a few sutures, supplemented

by flat sponges or Maunsell's diaphragm.

The Parietal Incision.—The incision in the first place need not be longer than four inches; large enough to admit the hand

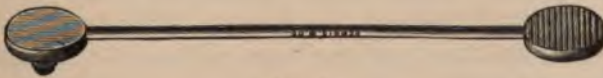


FIG. 82.
Pedicle Skewer for Hysterectomy. Half size.

for exploratory purposes. This incision may begin just below the umbilicus. Through it the tumour is examined with the

hand; we note the position of the ovaries, the broad ligaments and the Fallopian tubes, and the general relations of the growth to the uterus. We particularly note the position of the bladder, and guide the prolongation of the incision downwards accordingly. As far as possible, we get some idea of the presence and position of adhesions. Adhesions to liver, stomach or bowel are noted, and their care during delivery of the tumour provided for.

In a few seconds the hand will have given all the information desired, and the incision is now prolonged upwards and downwards to the extent deemed necessary. Many such incisions extend literally from sternum to pubes; if the tumour is very large and the parietes bulging, it may measure well over a foot in length. In one of my cases, a tumour with numerous cysts, where the solid matter of the tumour weighed eighty-nine pounds, the incision was just over two feet in length. It should be carried close down to the pubes, the bladder being pushed out of the way if it is in danger, and nearly always the upper end of the incision will rise above the umbilicus. The incision is best made by scissors guided by the forefinger inside the abdomen. Bleeding points are looked for at every cut and promptly caught in forceps. For reasons already given, the line of incision passes to the left of the umbilicus.

Separation of Adhesions. Delivery of Tumour. Division of Broad Ligaments.—Any adhesions which may exist between the tumour and the parietes are at once stripped by the hand. These are often very firm and they may bleed freely, especially on the tumour aspect. Pressure forceps should at once be placed on bleeding points; general oozing from the tumour may be partially checked by pressure from a large flat sponge, but may usually be ignored till the tumour is delivered. Any adhesions to bowel, usually in sulci of the tumour, are noted and if possible separated at once; if this is impossible, they are carefully watched during delivery of the tumour and separated as soon as they begin to drag on the adherent organ.

If there are no adhesions, the operation is much simplified at this stage.

We next proceed to delivery of the tumour. To assist in this, one or two myoma screws are inserted at convenient points and used as handles. Considerable force may sometimes be necessary to lift the mass out of its bed; and such force should always be guided and assisted by the left hand on the under surface of the tumour. The hand so placed not only makes certain that no injury is being done to underlying and attached structures, but by admitting air between the peritoneal surfaces removes the fixing influence of atmospheric pressure. By combined upward and lateral movements communicated through the screws in front and the hand behind, the tumour may in most cases be delivered through the parietal incision. While the tumour is being delivered adhesions are looked for and divided or peeled, according to their nature, on the lines laid down in the remarks on operations generally. A knuckle of bowel buried in a sulcus is easily torn during the delivery of a large myoma. If such delivery is fairly satisfactory and complete, the growth is turned downwards over the pubes, and measures are at once taken to protect, and prevent extrusion of, bowels. The insertion of a few parietal sutures, with the packing under the tumour of one or two large flat sponges, will usually be the best plan. Maunsell's diaphragm has been found valuable for this purpose.

If the position of the myoma in the uterus is such that the fundus is elevated, then the broad ligaments will be on the stretch; they may even prevent delivery of the tumour. If the tumour has grown away from the fundus, the broad ligaments may lie deeply and present no obstacle to delivery. Where a multiple myoma opens up the broad ligaments, it may be impossible to deliver the tumour at all until the broad ligaments are divided; the growth must in fact be shelled out of them. This, then, is the next detail of the operation to be considered—*the treatment of the broad ligaments*.

In every case I believe it is best to tie off the broad ligaments with special ligatures of their own, and never to include them in

any ligatures or clamps applied to the pedicle. By so doing we remove the district most liable to hæmorrhage from all gangrenous and septic influences which may originate in the pedicle however treated, and we at once cut off the main blood-supply from the tumour. Further, when the broad ligaments are divided more complete delivery of the tumour is possible, and manipulation is rendered more easy.

The simplest and perhaps the most commonly available method of dealing with the broad ligaments is that shown in Fig. 83. Here there is general enlargement of the uterus, and the uterine cornua with the origin of the ligaments are found at the top. When the tumour is turned out of the abdominal incision, the broad ligaments will be found on the stretch, and the tubes and the ovaries will be lying close to the

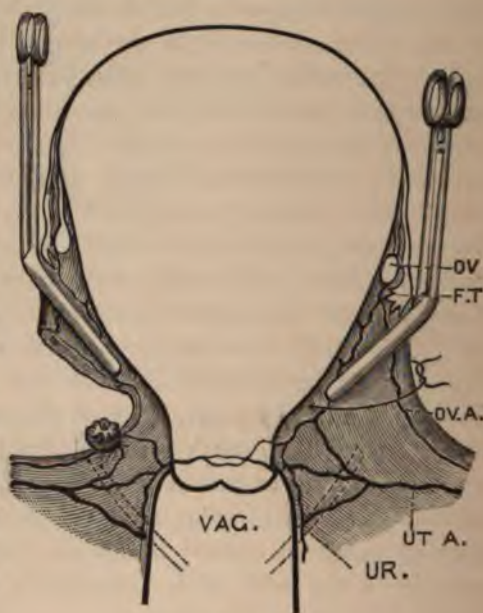


FIG. 83.

Ligation and Division of Broad Ligaments in Hysterectomy for Myoma. Forceps are placed on both ligaments outside the ovaries and tubes: on the right side the ligature is placed; on the left it is tied and the ligament is divided.

OV., Ovary; F.T., Fallopian Tube; OV.A., Ovarian Artery; UT.A., Uterine Artery; UR., Ureter; VAG., Vagina.

tumour some way down its sides. Each broad ligament is tied after placing a large pressure forceps (Fig. 76) on the uterine side, beyond the ovary and tube. This forceps checks all bleeding from the uterine side of the broad ligament, and is left on till the tumour is removed. Then the broad liga-

ment at the tip of the pressure forceps is pierced by a bent pedicle forceps and a silk ligature is placed around the tissue. This ligature should be tightened as the broad ligament is divided close to the pressure forceps. If ligation is made before division—that is, while the ligaments are on the stretch,—it will not be tight enough to be certainly secure. If it is gradually tightened as the ligament is severed close to the forceps, each successive cut will enable the ligature to be drawn more tightly till, when division is complete, ligation is perfect. This ligature includes the ovarian artery, the anastomosis between it and the uterine artery, and perhaps one or two branches of the uterine artery. (Fig. 83.) With these arteries it includes the plexus of veins, often enormously dilated, which accompanies them. The ligature, to include all these vessels, should pass quite close to the uterus at the point of the pressure forceps; when the tissues are ligatured, the stump tends to fall away from the uterus. This ligation of broad ligament should be done with deliberate and fastidious care, for much depends on it. When concluded, the stump is pushed to one side and no more is seen of it. If the ligaments are long, two or even three successive applications of the forceps, each below the previous one, and as many ligations may be necessary. But the steps are the same. When the broad ligament on one side is tied off and divided, the same is done with the broad ligament on the other side. With division of the broad ligaments, the tumour is freed from all save its vaginal attachments, and can be more freely moved about and more easily delivered.

In another class of cases the growth is away from the fundus, and the broad ligaments arise at some point between them and the base of the growth. The ligaments are, if possible, tied off after application of pressure forceps on the uterine side, just as before. But in some cases where the broad ligaments lie deeply and the tumour fills the pelvis, it is impossible to apply the ligature satisfactorily: then the ligaments must be divided between two pairs of forceps, and the distal forceps left on till ligation is possible after delivery or removal of the growth.

In such a case the advantage of my pressure forceps, which hold as well laterally as vertically, will be conspicuous. A ligature is placed below them and tightened as the forceps are slowly removed. In such a case, with deep deligation, it is always wise to feel for the ureters so as to avoid, if possible, the risk of including them in the ligature.

A third class of case is where the tumour-growth opens up one or other, or both, broad ligaments. Here we may expect the tumour to be held down in the pelvis, perhaps filling it and pressing on the rectum, even causing obstruction. I have had to operate on three such cases during obstruction and with distended intestines, and the manipulations were not easy. Here generalised rules are useless; the surgeon must work on the impulse according to his lights. In most cases, until the growth has been freed, delivery will be impossible, and ligation will be postponed till then. The space between the folds of the broad ligaments will be opened up, and consecutive divisions be made between forceps until the whole of one side has been freed; then the other side is freed in the same way. When this is done, the growth may be delivered through the parietal incision. In this variety of case the ureters are specially liable to injury. Several surgeons, myself amongst the number, have recorded cases where a portion of the growth has undermined a ureter; and more than once the ureter has been divided. The ureter should always be looked for. It can often be felt as a hard rounded cord overlying the bifurcation of the common iliac artery; if at this point it dips down into the pelvis, it is almost certainly out of danger; if it is raised with the pelvic peritoneum over the tumour, it is in danger. The ureter will bear complete denudation of peritoneum and areolar tissue; and, as I know from experience, somewhat rough handling. If by mischance it is divided, it should at once be united by the operation known as uretero-ureterostomy (*See "Surgery of the Ureters"*). Kelly by a brilliant operation has shown us what success may follow this proceeding.

In the case of multiple myomata growing between the

layers of the broad ligaments, separate enucleation of each growth may be the simplest method of completing the operation. When several such myomata are shelled out the central uterine mass may easily be delivered. The broad ligaments, according to the amount of bleeding, may require forcipressure during enucleation; or this, with deligation and division, may be delayed till after enucleation of the lateral growths and delivery of the central mass.

We now have the tumour delivered as fully as its attachment to the vagina and the lower portion of the broad ligaments will permit it. Pressure forceps are attached to the surfaces where broad ligament has been attached. The bladder is pushed well down under the pubes, and the tumour is turned over it, and rests on the macintosh over the thighs. Sponges are packed into the pelvis behind the tumour, to keep intestines out of the way, and to soak up any blood that may have escaped or may escape. The next step is now—

Application of Serre-nœud; and Amputation of Tumour.—In every case I consider it best to amputate the tumour before finally deciding on the treatment of the pedicle. If we decide on extra-peritoneal treatment of the pedicle, this may be the end of the operation proper. If we decide on intra-peritoneal treatment of the pedicle—which means, or in my belief ought to mean, complete removal of all uterine tissue—the further proceedings may be carried out with much greater facility after the tumour is removed than while it remains obstructing the view and impeding manipulation.

The surgeon will probably have some idea as to the method he will adopt. If complete intra-peritoneal treatment is to be adopted, Tait's temporary rope-compressor, which acts very quickly and will not slip, will be thrown round the neck of the growth and tightened before amputation. If extra-peritoneal treatment seems the most likely method, and a suitable site for its application is accessible, the serre-nœud or the elastic ligature may at once be applied. In any case where the balance between the methods seems even, a rope-compressor may be applied and

the decision left for the further and more complete examination rendered possible after removal of the growth.

In every case, before the rope, wire, or elastic is tightened, its course around the growth should be examined by touch and sight. This is done to make certain that no portion of bladder or bowel is included. It is easier than might be supposed to incur this accident; and it may be very difficult to remedy it by slackening the constrictor after the growth is removed.

The constrictor being satisfactorily applied and tightened, the growth is now amputated an inch or so above it by a few strokes of a large scalpel. Blood will probably flow freely from the tumour during division, and sponge-cloths should be placed below to catch it. The tumour, with attached forceps, ovaries, and tubes, is now removed; and we proceed to consider what is by some considered to be the crux of the whole operation—the treatment of the pedicle.

Treatment of the Pedicle.—This, the most important detail in the operation, demands full consideration and discussion.

The discussion has been between two rival methods—the intra- and the extra-peritoneal. In the former, the pedicle has been treated clamped in the wound outside the abdominal cavity; in the latter, the pedicle has been treated after ligation in various ways, free inside the abdominal cavity. A third method, in which properly speaking there is no pedicle at all, but where every particle of uterine tissue has been removed, ranks under the intra-peritoneal methods. A fourth method, called “mixed,” in which the pedicle is fixed under the parietes, is reckoned as partly intra-peritoneal and partly extra-peritoneal.

Now, extra-peritoneal methods may be gathered in a group naturally and definitely for purposes of description and classification. This cannot be said of intra-peritoneal methods. These include, firstly—those in which no uterine tissue whatever is left; secondly, those in which only cervical tissue is left; and, thirdly, those in which portions of growth as well as uterus are left. To group these together as intra-peritoneal and compare them as a

whole with the extra-peritoneal methods is futile for all purposes of real good.

Then the issue has been obscured by arguments which are misleading. Thus, it has been argued that the extra-peritoneal treatment, with its manufacture of slough, is unsurgical. To this it may be answered that, as the end of surgery is the saving of life, the best surgery is that which saves most lives. That it creates sloughing is an incident, but not an objection from the surgeon's point of view if more lives are saved thereby. Further, it is argued that as catastrophes followed the introduction of the clamp and extra-peritoneal treatment of the pedicle in ovariectomy, so ought it to follow extra-peritoneal treatment of the pedicle in hysterectomy. There is a double fallacy here. There is, firstly, the assumption that disaster would follow the clamp in ovariectomy to-day as it did years ago. Personally, I have no doubt that the mortality would scarcely be influenced by the re-introduction of the clamp in ovariectomy, for, with our modern methods, the risks would be almost done away with. And, secondly, there is the assumption that the tissues in the ovarian and the uterine pedicles are identical and equally amenable to ligation. It has needed many practical disasters to prove the fallacy of this argument, and it dies hard even now. In fact, no argument from the pedicle in ovariectomy to the pedicle in hysterectomy is possible: the pedicle in hysterectomy is a thing *sui generis*, and occurs nowhere else in all surgery.

The whole difficulty rests in the nature of the pedicle—its physical and physiological characters. Inorganic muscle, particularly if myomatous, is so hard that it can be compressed so as to give hæmostasis only by the application of great force; it is so friable that it breaks up readily; when starved of blood, it readily sloughs; and, lastly, it rapidly undergoes physiological and fatty atrophy and softening. If hæmostasis were the only difficulty, every pedicle might be safely cast loose in the cavity. But the chief dangers begin when the risk of hæmorrhage is over. Softening and sloughing, with loosening of foul discharges into the peritoneal cavity, are what we have to dread. A piece of devascularised

myomatous tissue left in the abdominal cavity is always a source of danger; and no method yet invented has succeeded in removing this risk. According to Vautrin, in supra-vaginal amputations the general mortality with intra-peritoneal treatment of the pedicle has been 56.2 per cent.; with extra-peritoneal, 33.3 per cent. His figures have not been disputed, and time goes to confirm the proportion of the death-rates, although both diminish. In other words, the death-rate after intra-peritoneal treatment is nearly twice as great as after extra-peritoneal. This, in my opinion, is enough to condemn it. I have definitely come to the conclusion that, after amputation, no pedicle which contains myomatous tissue should be left free inside the abdominal cavity. In other words, if intra-peritoneal treatment is adopted, there should be complete amputation of the whole organ; there is then no pedicle at all. The broad ligaments and the top of the vagina represent the pedicle; they contain no tissues likely to slough or atrophy. Therefore only two methods of treating the pedicle will be described:—

I. *Extra-peritoneal*—the pedicle being fixed in the parietal wound, and left either open to the air or fixed under and covered by the parietes and drained.

II. *Intra-peritoneal*—all uterine tissue being removed, and the top of the vagina being closed.

EXTRA-PERITONEAL TREATMENT OF THE PEDICLE.

Historical.—This is the original plan of Kimball, Wells, and Koeberlé. Kimball used the actual cautery, with fixation in the lower end of the wound. Wells transfixed the pedicle with two strong needles; below these he placed a ligature, and fixed the stump in the parietal wound. In 1864 Koeberlé introduced his wire clamp for the treatment of the pedicle; and this instrument, with various modifications, and his method, still continue in favour. Many other varieties of extra-peritoneal treatment have been invented, and many instruments have been introduced. In this connection the names of Péan and Cintral deserve mention

for their wire clamps; and those of Baker Brown, Keith, Kiwisch, and Wells for their special unyielding clamps.

Operative Details. — The actual carrying out of the extra-peritoneal treatment involves attention to the constriction of the pedicle, the arrangement of the parts around it, and the subsequent treatment of the necrosing tissues.

As to the modes of constriction, we may confine our attention to three methods; viz., (1) by the wire-constrictor, (2) by the elastic ligature, and (3) by the clamp. The first is the favourite method, but the elastic ligature is employed by many distinguished surgeons. The clamp has the imprimatur of Keith, but has not come into general use.

The Wire-constrictor as introduced by Koeberlé (Fig. 77), or as modified by Tait (Fig. 78), Elder (Fig. 79), and Bantock, remains the favourite instrument for constriction of the pedicle. I now use aluminium wire in preference to wire of "Delta" metal, which, in its turn, is superior to piano or steel wire. Steel wire is too stiff; it may cut before it constricts. Wire made of "Delta" metal is very strong and pliable while it is not ductile, and serves the purpose admirably. The sole advantage which aluminium wire possesses is its great pliability, enabling it to be easily adapted round the pedicle and to the *serre-nœud*. With Tait's instrument (Fig. 78) the two ends of the wire are simply pulled tightly round the pedicle, slipped through the loop at the end of the shaft, and hooked into the claws on the sliding screw. With Bantock's modification of Koeberlé's instrument (Fig. 75) one end of the wire is looped on to a button or screw, and the other is pulled over the same button and fixed there. In Elder's instrument the wire is fixed by pushing it through a hole in the bar on which it is wound up. For Elder's instrument the wire should be very pliable.

The pedicle surrounded by the rope-compressor, with the ligated stumps of the broad ligaments a little way off on each side (Fig. 84), is examined all round to make certain that bladder and bowel are well clear of the line of constriction, and to fix on a suitable place for the application of the wire. The wire of the

serre-nœud will usually be placed below the rope, but sometimes may lie almost in the same groove. The peritoneum may be ignored, except that pouches or folds of loose peritoneum should not be left behind or in front. Any elaborate arrangement of the peritoneum of the pedicle is superfluous; beyond avoidance of the leaving of

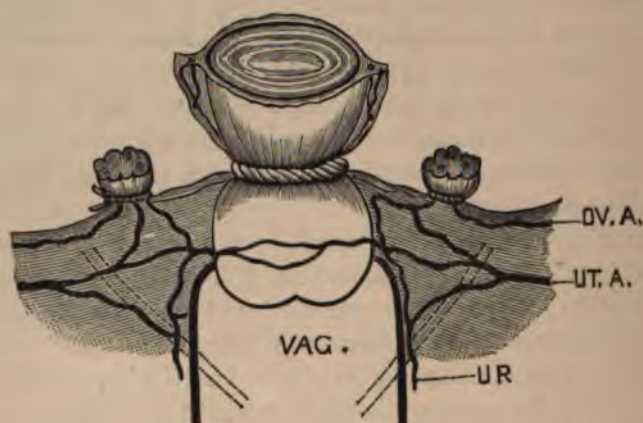


FIG. 84.

Pedicle in Hysterectomy, with rope-constrictor applied. Broad ligaments tied; stumps shown.

OV.A., Ovarian Artery; UT.A., Uterine Artery; VAG., Vagina; UR., Ureter.

loose folds, nothing need be done to the peritoneum. I prefer to have the serre-nœud resting over the pubes, its shaft being in the bottom of the parietal incision; some surgeons place it laterally resting on the parietes, but one position is nearly as good as the other. When the wire is passed round and moderately tightened the rope-constrictor is removed; then the wire is tightened to the fullest extent possible short of cutting. At the end of the operation it may be possible to tighten it a little further; thereafter it ought not to be touched, unless bleeding or oozing from the stump takes place. Complete anæmia of the tissue above the wire is all that is desired; with this it is impossible to avoid anæmia of the tissues for some little way below the pedicle. To frequently tighten the pedicle-constrictor

is to cause downward extension of the limit of necrosis. If the limit of absolute anæmia or necrosis is made at the time of operation, the line of demarcation and separation begins almost at once and is not disturbed; if the screw is tightened on successive days the vascularization is disturbed, a new area of sloughing is made, and a new line of separation has to be formed. When the pedicle is dry and dead the *serre-nœud* may be removed. This may be done from the third to the fifth day. I see no advantage in keeping it on longer, and considerable disadvantage in tightening it up daily in the hope of promoting separation of the slough.

When the constrictor is satisfactorily placed, the pedicle skewers (Fig. 82) are inserted just above the wire. They are placed above the wire to prevent slipping, and they should be placed before trimming down the pedicle in case the tissues retract. They may be placed parallel to each other across the incision, or may be passed crucially. Often one pedicle needle will be sufficient. These needles keep the pedicle up in the wound: to do this they may have to bear a considerable strain. In a few days the vaginal tissues become stretched, and this strain is relieved. They should always be placed so that the constricting wire is well within the parietal wound, so that the parietal peritoneum will lie below the downward limit of necrosis.

When constrictor and needles are placed the pedicle is trimmed down by scissors close to the needles, leaving only enough tissue to give a firm hold. The smaller the pedicle the more rapidly and easily is it desiccated. The use of styptics or destructive chemicals or heat to the surface of the pedicle I do not advise. Bleeding should be stopped by the constrictor; charring the surface locks up the fluids and keeps the pedicle œdematous. A little boric acid powder rubbed in on the surface helps to keep it sweet. Uterine or cervical mucous membrane should be scraped away.

In arranging the pedicle at the bottom of the incision, the parietal peritoneum should be pushed down (Fig. 85), so as to go well below the lowest limit of pedicle necrosis. To pull up the parietal peritoneum and stitch it to the skin is, in my opinion, to

increase the risk of peritonitis from trickling in of the fluids. If the parietal peritoneum is well pushed downwards, and laid on or fixed by a stitch with its raw surface to the peritoneum covering the stump, it will have become glued thereto before sloughing proper will have commenced, and will efficiently bar the way to the general cavity when sloughing is going on.

The whole of the stump above the wire, and a small portion below it, are removed by pressure necrosis. A sort of dry gangrene which is not actively putrefactive, and which does not set loose foul discharges, is sought to be produced. This is best done

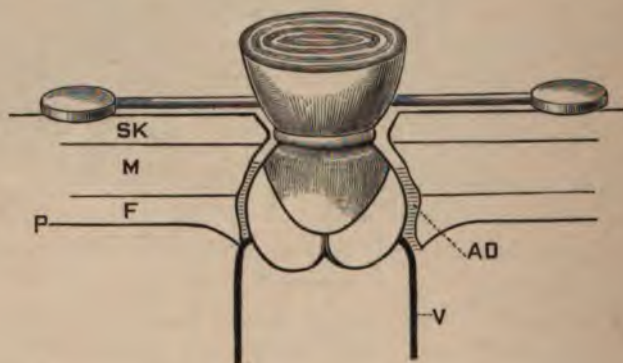


FIG. 85.

Pedicle in Hysterectomy placed in Parietal Wound. Shaded portion represents area of necrosis.

SK., Skin; M., Muscular Layer; F., Sub-peritoneal Fatty Tissue; P., Peritoneum; V., Vaginal wall; AD., Adhesions which shut out the peritoneal cavity.

by packing it all round with little squares of boric lint or similar dressing, which is actively absorbent and antiseptic. In a few days the tissues become mummified, sometimes getting as hard almost as wood. As already remarked, I do not think that the separation of the slough is promoted by tightening of the ecraseur-screw; rather do I believe that it causes the slough to extend downwards. As soon as the tissue is dead and drying, I remove the constrictor, leaving the wire perhaps for a few days longer, simply because its removal may cause disturbance of the young

adhesions. A slough is cast off most quickly when the blood-supply to it is free and abundant; intermittent or constant increase of the constricting force brings new outlying tissues under its influence, checks the flow of blood, and thereby delays separation of the slough. I usually remove the clamp on the third or fourth day, never, if possible, having tightened it at all. The skewers are left till the slough separates, and removed with it. This separation is usually complete by the tenth day, often sooner. Little pieces of dry absorbent antiseptic lint are packed all round the pedicle between it and the parietes, to absorb any discharge that may appear, and to prevent its burrowing along the incision or forcing its way into the abdomen. The stump remains sweet all through, and gives out no odour.

The parietal incision is closed in the usual way, close down to the pedicle. The lowest stitches should be inserted so as to draw the tissues closely, but not tightly, round the pedicle. It is a good plan to so place a stitch that when the pedicle is removed it can be tied, and effect approximation of the lips of the opening left. The parietal wound above the pedicle is dressed with boric lint, and fixed by strapping in the usual way. It need not be looked at for a week or longer. For reasons already given, I now leave in the stitches for two or three weeks.

When the pedicle separates, a deep granulating hollow is left, which usually fills up and skins over in two or three weeks more. In a few cases the granulations are not perfectly covered with epidermis for months. In such cases an occasional discharge of blood, coincidently with the periods at which menstruation should appear, has rarely been observed.

The Clamp.—Keith, so far as I know, is the only highly successful operator who uses the clamp. It is a special instrument, made very large and thin. (Fig. 86.) He says: "I have not found sloughing take place to the extent that it does when a single wire merely embraces the pedicle; the parts are more spread out in the clamp, and there is not nearly the amount of puckering of the soft parts that there is when a wire is used. A mass, as thick as the wrist, can be squeezed into a loop an inch,

or three-quarters of an inch, in diameter; whereas, with a large clamp there is no great pressure on any one part below. The pressure of the wire does not act simply on the constricted portion, but exerts its influence to some distance below the constriction. . . . Before applying the clamp, it is better to draw all the parts gently together by a thick silk ligature or by a soft wire. This prevents a too great spreading out of the

parts between the blades, which would render the closing of the wound around the clamp somewhat troublesome." Keith applies freely to the stump a saturated solution of perchloride of iron in glycerine, and then dries it off; after this, plenty of iodoform and salicylic wool. The cervical canal is scraped out and disinfected.



FIG. 86.

*Keith's Clamp for Hysterectomy.
One-third size.*

The Elastic Constrictor.—The elastic ligature has many supporters; Olshausen, Martin, Sãnger, and Hegar, being among the chief. It may be applied either as an encircling ligature, around the whole; or as a transfixing ligature, embracing the pedicle in halves; or as a double ligature, encircling and transfixing. For applying the ligature around

the pedicle, the ingenious instrument of Pozzi (Fig. 81) will be found valuable. With it, any requisite amount of tension can readily and rapidly be applied, and the instrument automatically keeps up whatever tension is put on. For carrying the ligature through the pedicle Hegar has invented a transfixing needle. (Fig. 87.) It is composed of two parts—a sharp conical piercing

point, which screws off; and a hollow tubular portion split along the side, into which the ligature is drawn in a loop. The knot made in the elastic ligature is, if necessary, finally secured by surrounding it with a strong silk ligature. Terrillon and Trélat have quite recently introduced ingenious instruments for the application of the elastic ligature. Hegar lays particular stress on the mode of closing the abdominal wound by peritoneal suture, and on the fixation of the pedicle in its lower angle. (Fig. 86.) To prevent retraction where the pedicle is short, pedicle needles should be pushed through it. The elastic ligatures are cut away about the eighth or tenth day.



FIG. 87.
(HEGAR AND
KALTENBACH.)

*Needle for carrying
elastic ligature through
Pedicle.*

be done by winding the ligature around the pedicle several times (Fig. 89), and fixing it by a simple knot reinforced by a silk ligature.

Then no serre-nœud or tightening apparatus is necessary. The elastic would closely follow up the tissue as it shrivels from



FIG. 88.

(HEGAR AND KALTENBACH.)
*To show closure of Abdominal
Wound (a);
and treatment of Pedicle by
elastic ligature (b).*

atrophy and desiccation, and bleeding would be impossible. The pressure would not be increased, and the risks of downward extension of the necrosis would be avoided. Skewer, slough, and elastic would all be removed together.

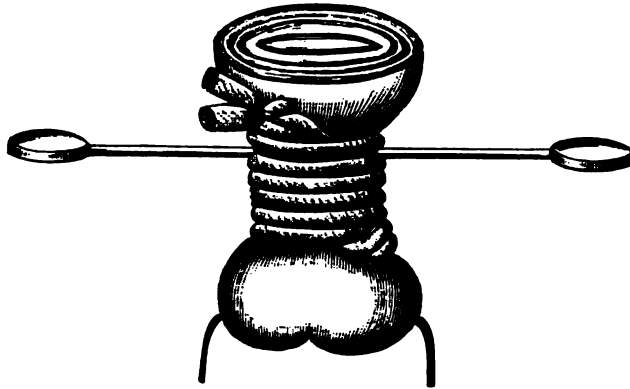


FIG. 89.

The Elastic Ligature in treatment of the Pedicle in Hysterectomy.

Intra-Peritoneal Treatment of the Pedicle. Total Hysterectomy.

Historical.—In 1874 Kaltenbach proposed intra-peritoneal treatment for small pedicles, with suture of the edges of the wound in the uterus and of the broad ligaments. Hegar* about the same time employed this plan with success. In 1877 Kleeberg† suggested the elastic ligature, and proved its harmlessness in the abdominal cavity by experiments. In 1878 Czerny‡ put the idea into practice by leaving the elastic ligature surrounding the pedicle inside the abdomen. Wells, Koeberlé, Péan, and others about this time recorded cases of intra-peritoneal treatment of the pedicle chiefly by multiple ligatures, but with no very encouraging success. Olshausen, Fritsch, and Leopold had fair results with the elastic ligature; but Martin, Tauffer, and a few others somewhat discredited this method by showing that it sometimes caused sloughing of the pedicle, or suppuration and septicæmia.

By far the most important systematic attempt to arrive at a trustworthy intra-peritoneal treatment of the pedicle was made by Schroeder.§ Schroeder's plan is essentially multiple ligature of bleeding points, and deep and superficial suture of the wound in the uterus. He began by the application of a temporary elastic ligature near the neck of the uterus, then separately ligatured the vessels in the broad ligament which supply the uterus, and finally dealt with the uterine wound. Martin advocates Schroeder's plan, with the substitution of silk for catgut as material for ligature. To the mucous membrane of the exposed cavity carbolic acid, or corrosive sublimate, or the actual cautery, is applied to cause disinfection. Leopold, von Antal, Thiriar, Olshausen, Fehling, Kocher, Treub, Fischer, Marey, and many others, have introduced unimportant modifications.

* *Operat. Gynäk.*, Stuttgart, 1880. † *St. Petersburg med. Woch.*, 1877 and 1879.

‡ *Centralbl. f. Gynäk.*, 1879, p. 519.

§ *Zeitschr. f. Geb. und Gynäk.*, 1881, p. 213, and 1883, p. 204; and *Brit. Med. Journ.*, *loc. cit.*

The disadvantages of leaving the pedicle, however treated, inside the abdominal cavity have already been dwelt upon, and need not be recapitulated. In the hands of the most skilful surgeons it has had a mortality nearly twice as great as the extra-peritoneal method, and this, in my opinion, is sufficient to condemn it.

The attention of surgeons was then directed to complete removal of the uterus and cervix, leaving no pedicle in the ordinary sense, and several have elaborated some special variety of method. Still the mortality is greater than in the extra-peritoneal method. Doyen himself, in his own operations, had 4 deaths in 28 operations by his own method. Mangiagalli* has collected the most extensive series of statistics of hysterectomy which I have seen—nearly two thousand cases in all. The intra-peritoneal mortality was 23.2 per cent.; the extra-peritoneal, 21.5 per cent. This does not separate complete from partial hysterectomy, and is therefore not quite conclusive as regards the points under discussion; still it is sufficiently suggestive.

Now, it is probably true that the worst cases are the extra-peritoneal ones—those in which a prolonged operation has to be rapidly finished. A selection of method is possible in the easier cases: the more perfect method surgically is the intra-peritoneal, and this the surgeon selects where he can. The intra-peritoneal should give the better result statistically therefore; but it does not. It may do so soon; if it does, it will, I believe, be by the method of complete removal of all uterine tissue.

Various ingenious methods of turning the stump into the vagina have been devised and carried out in practice. I believe, however, that when the operation has got as far as this the stump may as well be completely removed. It is scarcely more difficult to do so; it would take no longer time, and it removes whatever risk remains from the behaviour of the pedicle.

Operative Details.—In any case where complete hysterectomy is contemplated the vagina will have been purified as thoroughly as possible. If there has been bleeding from the uterus during

* *Ann. d. Obstet. & Gynec.*, April, 1894, p. 161.

the operation, or if there is any doubt as to the asepticity of the vagina, a mopping out with some strong antiseptic may be instituted before the actual removal of the pedicle is carried out.

We begin where we left off after amputation preparatory to placing the wire-constrictor. The convenience of carrying down both operations to the same point, and then deciding as to intra- or extra-peritoneal treatment, is obvious. Several conditions would influence us in making the decision apart from the mortality. The condition of the patient would influence us. If the operation has been a very serious one and the patient is collapsed, we should, even if the case is otherwise suitable for complete extirpation, perform the more speedy operation—the extra-peritoneal. Then again, if the vagina is very short, or the parietes very thick, or the cervix very large; if, in fact, the local conditions make total hysterectomy very difficult and possibly demand somewhat prolonged manipulation, we might select the extra-peritoneal method. Anyhow, it is convenient not to have to make the decision till the last moment.

When the decision is made for the intra-peritoneal method, a large claw forceps is placed on the stump, wherewith it is manipulated with the help of an assistant. A uterine probe or similar instrument placed in the vagina accurately determines the attachment of vagina to cervix. For this purpose Jessett's bivalve obtura-

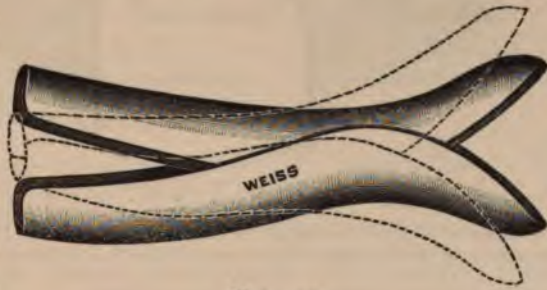


FIG. 90.

Jessett's Bivalve Obturator for total Abdominal Hysterectomy. One-third size.

tor (Fig. 90) will be found very useful. When inserted, it raises and keeps on the stretch the top of the vagina in front and behind, and serves as guide both to the finger and the knife.

Another and lower deligation of the broad ligaments is now

carried out. The danger here is in including the ureter in the ligature. This is avoided by placing the ligature close to or a little below the junction of cervix and vagina, while the ureter is pushed outwards. It is often quite easy to palpate the ureter, and this should be attempted. If it cannot be felt, its absence from the line of ligature may be insured by pinching the ligament to be tied and squeezing all superfluous tissue outwards. The ligature is inserted by the bent pedicle forceps (Fig. 91), and tied, while the attachments to cervix and vagina are divided by scissors. These ligatures include all the branches of the uterine artery which it is necessary to secure. If they are carried low

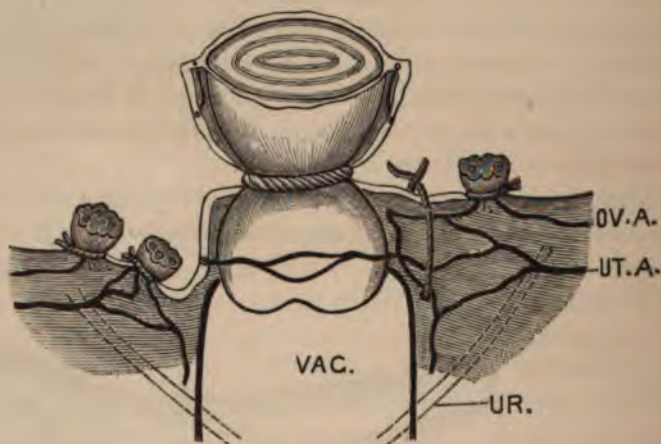


FIG. 91.

Removal of stump in complete Hysterectomy. On the right a ligature to the inside of the stump of the broad ligament, and including all the branches of the uterine artery except those passing down the vagina, is placed in position. On the left this ligature is tied and the tissues between it and the cervix divided.

OV. A., Ovarian Artery; UT. A., Uterine Artery; UR., Ureter; VAG., Vagina.

enough, the rest of the operation will be almost bloodless. In cases of myoma the venous plexuses in this region are often very large, and deligation should be carried out with great care. If the ligature is slowly tightened during and after division of the tissues, satisfactory and permanent occlusion may be safely

reckoned on. After ligation, however, it will be wise to place forceps on each stump and leave them there till the end of the operation. (Fig. 92.)

The peritoneum is now divided all around the cervix below the rope-ligature. This may easily be done by scissors pushed in



FIG. 92.

Removal of stump in complete Hysterectomy. The uterine arteries are divided and tied. The Peritoneum (P.) in the recto-vaginal and vesico-vaginal spaces is turned over, and the incision (IN.) at the top of the vagina is begun.

at the lateral gaps between the layers of the broad ligament. A little care in front will easily avoid the bladder; by pushing it forward the peritoneum is put on the stretch and raised. The rectum behind is endangered by going too low. When the peritoneum is stripped there is only vaginal tissue overlying the obturator or probe in the vagina. An opening is made at the top of the vagina on the protruded guide, and a few strokes of the scissors make the complete division, as close as possible to the cervix. The pedicle or stump is now detached and is removed. A catch-forceps placed at each angle of the separated vagina serves for manipulation during the next stages.

All that now remains to be done, beyond perhaps the securing

of a few bleeding points, is to close the top of the vagina and to cover it up with peritoneum. This may be done by a continuous suture of catgut or kangaroo tendon traversing its outer walls, but not piercing the mucosa. (Fig. 93.) If properly applied, it should bring into apposition the intumed areolar surfaces on the outer aspect of the vagina, and cause eversion of the mucous membrane into the canal. Such a suture may well be puckering as well as apposing. Over the closed vaginal vault the peritoneal flaps are sutured by a continuous silk suture (Fig. 93), also infolding, and the operation is finished.

The pelvis is carefully cleansed by sponging, and the parietal

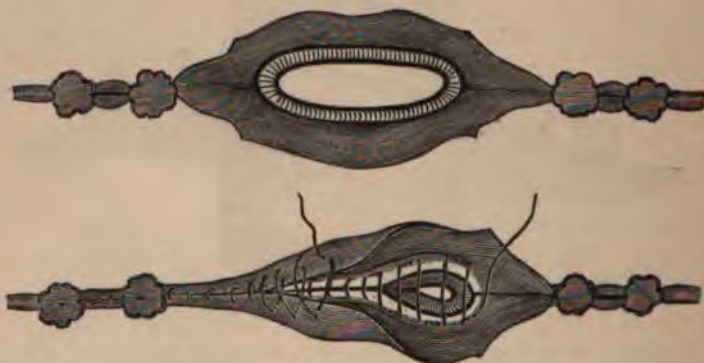


FIG. 93.

Complete Hysterectomy. Top of vagina and broad ligaments after removal of the uterine tissues. The upper diagram shows the stumps of the ligated broad ligaments, the outfolded flaps of peritoneum and the top of the vagina. The lower diagram shows the application of continuous sutures to vagina and to peritoneum.

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incision is closed in the usual way. If there is the slightest doubt as to the perfection of any part of the operation, a drainage tube should be inserted. It may be removed at the end of the first or second day if all is going well.

The vagina should be drained and kept dry; this, not only to prevent any possible leakage from vagina into peritoneum, but to insure immediate absorption of any discharge from the sutured vaginal vault. Strips of gauze sprinkled with iodoform, and changed daily, make the most satisfactory vaginal drain in this operation.

After-Treatment in Hysterectomy for Myoma.

The general after-treatment, being to all intents and purposes the same as after ovariectomy, requires no special description. Pain is sometimes rather severe, and may require the hypodermic injection of opium; this however is, if possible, to be avoided. The bladder being in some cases crowded down on the pubes, and in others having been somewhat roughly handled, requires special and careful attention. Pain may often be relieved by emptying the bladder.

In cases of extra-peritoneal treatment of the pedicle, the nurse must look sharply after the stump to see that bleeding does not take place; and she must know how to tighten the screw so as to check the bleeding.

When the stump is hard and dry the wire must be cut and the *serre-nœud* may be removed, the wire being left in place. The needles are left in place till the stump separates; they keep the stump well up in the wound, and may help in its removal by packing lint under them on the parietes. All around the pedicle, between it and the wound, small squares of boric lint are packed; these absorb any discharge, and prevent its trickling into the abdomen. They may be left unchanged for the first four or five days: thereafter I like to change them daily till the slough separates.

In intra-peritoneal treatment, with removal of the whole uterus, there is nothing special to be attended to beyond keeping the vagina aseptic and dry. The urine should be passed through the catheter for the first few days; the external parts should be kept scrupulously clean; the vaginal tampons should be changed daily, and an occasional vaginal douche should be given. Any rise of temperature, with pelvic tenderness, should make us examine for pelvic phlegmon around the vaginal vault: this is the chief danger after shock, and should be promptly met by undoing the vaginal sutures and opening up the areolar tissue into the

vagina, so as to permit of free drainage and the application of antiseptics.

Fixation of Pedicle to Parietes.—A few surgeons have made use of this method of treating the pedicle after hysterectomy. Necessity rather than choice would usually determine the employment of this method. A very short stump, with the presence of myomatous tissue low down in the cervix, and great vascularity would be the conditions most usually found to recommend the plan. The details of the proceeding require no description.

Hysteropexy.

By this operation is meant fixation in normal position of an abnormally situated, retroverted, or prolapsed uterus. This term includes three operations—two extra-peritoneal, and one intra-peritoneal. They are as follows :

I. *Inguino-hysteropexy*.—This operation, by shortening the round ligaments, was originated in 1882, independently, by Alexander* and by Adams,† but is usually known as Alexander's operation. It may be employed in all cases of backward displacement where there are no adhesions, and in certain cases of prolapse.

II. *Kolpo-hysteropexy*, known also as *vaginal fixation*, was first described by Mackenrodt,‡ assistant to Martin of Berlin. Dührssen§ has had an extensive and favourable experience of the operation, and has given minute descriptions as to technique. Its applicability is the same as for Inguino-hysteropexy.

III. *Cælio-hysteropexy*, known also as *ventral fixation* and as *hysterorrhaphy*, is operative fixation of the displaced uterus to the anterior abdominal parietes after cœliotomy. The name hysterorrhaphy, which is frequently given to the operation, ought, if we follow etymological meaning, to be confined to the suturing of wounds in the uterus. It is difficult to say who originated this operation. Thomas Keith seems to have been one of the earliest operators; and between 1888 and the present day many surgeons have performed the operation. Perhaps Howard Kelly, by his clear and accurate description of technique, has done more than any one to popularise the operation. His first paper was published in 1886,|| and other papers since then have been published by him.

The operation by abdominal section has an applicability as wide as the other two, and includes also cases where the uterus is

* *Med. Times and Gaz.*, Lond., 1882, i., 327. † *Glasgow Med. Journ.*, 1882, xvii., 437.

‡ *Centralbl. f. Gynäk.*, Leipz., 1893, xvii., 665.

§ *Centralbl. f. Gynäk.*, Leipz., 1893, xvii., 681. || *Four. Am. Med. Ass.*, 1886, vii., 666.

bound down by adhesions which cannot be dealt with by the other methods.

Appreciation of Hysteropexy.—It is undoubtedly the fact that all methods of operative fixation of a malposed uterus have been received somewhat coldly by many of our best surgeons; and that no method has received universal or even general acceptance as an entirely praiseworthy procedure. The Alexander operation, after a very extensive trial, seems to have quietly dropped into a disuse which is more significant than abuse. Coelio-hysteropexy, or ventro-fixation, has perhaps been injured by an advocacy of over-zealous supporters, which amongst cautious men begets distrust. Vaginal fixation has scarcely had a full trial; but the fact that such an able surgeon as Martin of Berlin performs the operation and speaks well of it will bring many followers.

To the principle of the operation in general, and to each method of operation in particular, it is easy to urge objections. Broad objections are, that the operation does not attack the real cause of the trouble, and that the uterus is not intended to be fixed, certainly not as in ventro-fixation, by the fundus. Special objections may be raised to each operation. Thus, it is urged that to shorten the round ligaments can be at best but a temporary cure; for if they became stretched once, they will become stretched again. Vaginal fixation cures one disease—retroversion, by making another—anteversion; and may interfere with the functions of the bladder. Ventro-fixation is said to be altogether unnatural, and to induce risks of abortion and of intestinal obstruction; while its mortality has been altogether out of proportion to its value.

It is unnecessary to fully particularise the arguments for and against the various operations. In every instance the operation will best be considered as one of last resort; one to be undertaken only after all minor methods of treatment have been tried and found inefficacious, and where the urgency of symptoms is so strong that a certain amount of operative risk and possible uncertainty of result may with propriety be incurred. Each operation ought to be, and in good hands is, attended with

only a trifling risk. In selected cases, all other methods being exhausted, the surgeon is certainly justified in giving his patient the benefit of a trial of one or other of these methods of operation.

Where there are no adhesions binding down the uterus, the choice is perhaps equal amongst the three methods. Where there are intra-peritoneal adhesions, fixation by *cœliotomy* after division of the adhesions is the only method.

Alexander's Operation. Inguino-Hysteropexy.

The operation is performed with rectum and bladder empty. The pubes are shaved and thoroughly disinfected; and a sponge-cloth wrung out of hot antiseptic lotion is placed over the vulva between the thighs.

Alexander recommends two incisions made upwards and outwards, from one to two inches in length, starting from each pubic spine. I have a preference for a single curved incision carried just below the pubic spines and embracing both inguinal openings. When the included skin is raised as a flap, we get a free exposure of the inguinal openings and the surrounding aponeurosis, while the size of the single wound is smaller than the combined size of the double wounds.

The flap is reflected from the aponeurosis, and the external inguinal openings are easily seen, with a little pad of fat covered with thin fibres pouting from them. The thin fibres crossing the ring are divided, and the fatty protrusion bulges still further. The fibres of the round ligament, spread out in this fatty tissue, may or may not be visible; in any case, they are there, and if the tissue in the opening is grasped, so will be the ends of the round ligaments. Alexander prefers the use of an aneurism needle and the fingers for isolating and grasping these fibres; catch-forceps I have found more certain and equally efficient.

By traction first on one and then on the other of the two forceps, placed on the ends of the ligaments, it is now ascertained that they will run. The first pull must be made very gently and

carefully; when once they are started, the ligaments usually come out very readily. The uterus is now replaced by the sound; and, while it is kept in position by an assistant, the ligaments are drawn out as far as possible. As much as two or three inches of ligament may thus be drawn out of each inguinal canal.

They are now either fixed to the outer pillar of the ring or to the aponeurosis between the rings, or indeed to any part that seems convenient. The ligament should not be encircled by a ligature; this is liable to cause sloughing. A double or triple perforation of the ligament by silk-worm gut, and fixation under any part of the ring by piercing of the columnar fibres, is efficient enough. If the ligament is well buried, it is not likely to slough. As suppuration occurs more frequently than in most wounds, the insertion of drainage tubing is advisable. The wound is closed in the ordinary way and dressed. A Hodge pessary is inserted and worn for some weeks.

The operation is of the simplest possible character, and presents no difficulty beyond the risk of tearing through the delicate terminal ends of the ligaments. The power of the ligaments to pull forward and to hold forward the fundus is demonstrated in the most convincing manner at the operation.

The after-treatment requires no special description.

Kolpo-Hysteropexy. Vaginal Fixation of the Uterus.

The principle of the operation is to bring the body of the uterus into contact with the anterior wall of the vagina and to keep it there. To do this the areolar tissue underlying the peritoneum which fills the vesico-uterine pouch is opened up by an incision through the top of the vagina.

The steps of the operation as performed by Dührssen are as follows: The vagina is thoroughly disinfected and the operation carried out during irrigation with an antiseptic solution. A Sims' speculum is introduced; the uterus is drawn down by a vulsellum in the anterior lip, and the cavity curetted and mopped out with

an antiseptic. A sound placed in the bladder serves, in the hand of an assistant standing on the right, to push the bladder upwards and forwards. While the uterus is drawn down, a curved incision is made in the anterior fornix through the mucous membrane. The finger inserted through the opening thus made separates the areolar tissues all round, pushing the peritoneum upwards. To help in the separation it may be necessary to use scissors. A sound is now introduced into the uterine cavity, and the organ forcibly anteverted by an assistant on the left till it comes into contact with the finger of the operator in the wound. The body of the uterus is now pierced transversely with a curved needle threaded with silk; this ligature is handed over to the assistant on the right, who pulls the uterus down with it. A second ligature is similarly placed a little higher and pulls the uterus still lower. A third or a fourth ligature may then be placed, and their combined effect is to bring the whole anterior surface of the uterus into contact with the vagina. These are temporary ligatures, and are removed when the permanent ligatures are placed. The permanent ligatures grasp the submucous areolar tissue on one side, the uterine fibre and the submucous areolar tissue round the wound on the other side. About three such stitches are inserted. The vaginal wound is closed by a continuous suture of catgut. The vagina is packed with iodoform gauze.

No evil results are said to follow the operation. Dührssen claims a permanent cure in 130 operations (on 113 patients) of 89 per cent. The mortality has been thus far *nil*.

Mackenrodt employs a vertical median incision in addition to a curved transverse incision, and dissects the flaps off laterally with some freedom. A vertical incision along the vagina should be harmless, and gives more freedom in inserting the permanent sutures.

Cœlio-hysteropexy. Hysterorrhaphy. Ventral Fixation of the Uterus.

By this is meant operative fixation of a displaced uterus to the anterior parietes after cœliotomy. With this, in certain cases of great enlargement with metritis, is sometimes associated removal of the uterine appendages (Koeberlé, Klotz), the stumps being used for fixation.

The operation may be performed where the other methods of hysteropexy are available; it alone can be used where the uterus is fixed by adhesions. The presence of these adhesions fixing the organ in malposition is an indication for operation; their separation or division may be of as much importance in the case as the replacement of the uterus itself.

Various methods are in vogue in making the attachment of the uterus. Kelly passes the suspending sutures through the round ligaments close to the uterus. Sängér and Olshausen utilise the broad ligaments close to the uterus. Terrier fixes the fundus and a considerable portion of the anterior surface to the parietal wound. Leopold and most other surgeons fix the fundus only, or the fundus with a small portion of the anterior surface.

On the face of it, it seems wiser to make the attachment directly to the uterine body and not to rely on the presumably weakened and stretched broad or round ligaments. To rely on the ovaries or tubes for support, as has been done, is to upset physiology; to remove the appendages and fix their stumps is usually to do too much. The method selected is to attach the fundus, or the fundus with a little of the anterior wall of the body, to the anterior parietes. And to provide a certainty of strong adhesion, fixation is made, not to the peritoneal surface, but to the raw parietes, the peritoneum being turned backwards.

The Operation.—The Trendelenberg posture is very generally recommended, as in it the intestines usually gravitate away from

the pelvis towards the diaphragm. The opening, two inches or more in length, is made in the middle line in the usual way, and two fingers of the left hand are inserted and carried straight to the fundus; the state of the ovaries and tubes and posterior surface is made out by palpation, and the requisite nature and amount of manipulation decided upon. If adhesions are abundant and dense, it may be wise at once to raise the parts by the insertion and distension of the rectal bag. Adhesions in most cases may be safely separated by tearing with the fingers away from sight. If sight is deemed essential, a prolongation of the

incision and elevation of the parts by the rectal bag will be of material help.

Adhesions should be stripped away from the uterus or away from the adnexa, and not away from the bowels. As adhesions are separated and bleeding takes place, sponges are placed in the pelvis. These absorb blood and warn us of any excess of hæmorrhage requiring ligature or forcipressure. The use of scissors or scalpel can rarely be necessary.

The uterus and adnexa being freed, the organ is raised into the wound and the most

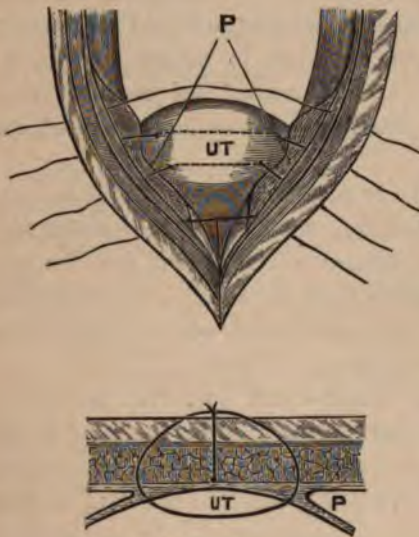


FIG. 94.

*Attachment of Uterus to Parietes in
Cælio-Hysteropexy.*

The upper diagram shows method of inserting sutures with outfolding of peritoneum. The lower shows in section sutures tied.

UT., Uterus; P., Peritoneum.

suitable position for fixation is decided upon. Two or three sutures of thickest silk-worm gut are now inserted by a curved intestinal needle into the fundus and a little way down the anterior aspect of the uterus. The needle passes under the

serosa and may traverse the muscular tissue for a little way. The sutures are buried over a distance of about half an inch.

The most perfect fixation will be got by turning back the parietal peritoneum and bringing the fundus into contact with the raw parietes. (Fig. 94.) This is done with great ease by means of a Reverdin's needle, or any other which places the sutures during withdrawal. For the left side, the left forefinger pushed into the retro-peritoneal fat separates the parietal peritoneum and serves as a guide for the needle. This is inserted as an ordinary suture; only it is first carried about half an inch further outward, then it is sharply turned backwards towards the left forefinger between muscle and peritoneum. The end of one of the uterine ligatures is caught and drawn out. Then the same proceeding is carried out with the other end. On the other side the same proceeding is carried out with changed hands.

The fundus and part of the anterior surface is thus brought into contact with a raw area, and the outfolded peritoneum adds to this area. The uterine sutures are tied first and the rest subsequently. A further certainty of permanence in the fixation is secured by turning out the peritoneum wherever the uterus comes into contact with the parietal wound.

The uterine sutures, if of silk-worm gut, may be left in place for several weeks. The others may be removed at the end of a week. Should it be desired to bury the uterine sutures and leave them permanently, some absorbable material, such as catgut or kangaroo tendon, must be employed. In the event of future pregnancy, silk-worm gut or any material which remains for long unabsorbed might cause trouble.

Other operations for fixation of the uterus after opening the abdomen are carried out by folding the round ligaments on themselves and suturing the folds. The operation of Wylie and Baer makes a single fold of the round ligament outwards; the operation of Dudley produces folding inwards, and suturing is made of the folded ligaments to the body of the uterus as well. These operations have not been generally adopted.

SECTION V.

OPERATIONS ON THE GRAVID UTERUS AND FOR ECTOPIC GESTATION.

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OPERATIONS ON THE GRAVID UTERUS AND FOR ECTOPIC GESTATION.

To save life in cases where, from any cause, delivery cannot take place through the natural passages, certain surgical measures are in use. These are, Cæsarean section; Utero-ovarian Amputation or Porro's Operation: Laparo-elytrotomy and Symphysiotomy. The last-named operation, devised by Sigault in 1768, had fallen into desuetude, but has within the past few years been successfully revived. The allied operations of Pelviotomy (Galbiati) and pubiotomy (Stoltz) have failed to secure the confidence of the profession and will not be described.

Total extirpation of the pregnant uterus has been performed, but only during the co-existence of cancer; and then the operation has been rather the extirpation of a cancerous organ which happened to contain a foetus, than one designed to save life endangered by obstruction to delivery. Bischoff* operated, in

* *Hegar und Kaltenbach. Operat. Gynäk.*, 2nd Ed., Stuttgart, 1881, p. 414.

1879, on a patient with cancer of the cervix in the thirty-fourth week of pregnancy. The patient died in eleven hours, and at the necropsy one ureter was found enclosed in the ligature. In 1881 Spencer Wells removed by abdominal section a cancerous uterus six months pregnant. The patient recovered from the operation; but the disease recurred not long afterwards. A case in which the writer removed a cancerous and pregnant uterus by the vagina during the second month of gestation can scarcely be included in this category. The patient recovered, but at the end of three years had recurrence.

Full consideration is given to four operations:

Cæsarean Section.

Porro's Operation.

Laparo-elytrotomy.

Symphysiotomy.

And, further, it will be necessary to describe separately the surgical treatment of

Rupture of the Uterus.

Extra-uterine Pregnancy.

Pregnancy in one horn of a Uterus bicornis.

With reference to Cæsarean section, Porro's operation, and Laparo-elytrotomy, the mortality, indications to operate, and appreciation will be considered conjointly, and, as far as possible, comparatively; so that, if such a practice be possible, there may be a selection of method according to the nature of the case.

SURGICAL ANATOMY OF THE GRAVID UTERUS.

The elaborate studies of Polk* on the relational anatomy of the gravid uterus are of great value. I have been able to supplement and confirm Polk's observations by two dissections specially made in view of surgical procedures. One was obtained from a patient in the ninth month of pregnancy, who died of

* *New York Med. Journ.*, 1884, xxxix., p. 485.

acute chorea. The other, in which labour had advanced till the os uteri was dilated to the size of a crown-piece, was got from a patient who died from fracture of the spine, caused by a fall. Both dissections are now in the museum of the Bristol Infirmary.

During pregnancy changes take place in the relations of the peritoneum, the uterine and ovarian arteries, the uterine ligaments, and the ureters.

As the uterus rises out of the pelvis, it carries the peritoneum with it. The elevation of the pelvic peritoneum, near the end of pregnancy, is so great that the reflection from the parietes to the uterus takes place somewhere near the level of Poupart's ligament. At the same time the cellular tissue becomes lax and distensile, and the attachment of the peritoneum is much loosened. This elevation of peritoneum and laxity of cellular tissue is so marked, that if an abdominal section is made transversely at the level of the internal ring, and the uterus is pushed to the opposite side, the true pelvis may be entered without encountering peritoneum at all. Even if it bulges into the incision, it can easily be pushed upwards. This change in the relation of the peritoneum renders the operation of Laparo-elytrotomy possible.

The broad ligaments are lifted out of the pelvis altogether, and become triangular instead of being quadrangular. The inner border, descending from the cornu to the internal os, is much broadened: its layers are separated and loosely attached, especially the anterior layer passing over the front of the uterus. The superior border, running between cornu and pelvic brim, is almost perpendicular. The lower border, partaking of the general elevation of the pelvic brim, now occupies the level of the upper border in the non-pregnant state, running straight across from pelvic brim to uterus. The outer border is obliterated. The uterus may, in fact, be considered as growing upwards between the folds of the broad ligaments, carrying these and the peritoneum continuous with it.

The round ligaments, greatly enlarged and elongated, descend in the anterior folds of the broad ligaments in straight lines from their insertion at the cornua to the internal rings. Nowhere do

they descend below the pelvic brim. They may be considered as instrumental in raising the peritoneum from the iliac fossæ.

The arteries are much enlarged—the ovarian more, in proportion, than the uterine. The uterine artery is straightened, and is elevated so that it is, in part, removed from the pelvic wall. Its relations to the ureter are not much changed. The ovarian artery, after it reaches the bifurcation of the iliac, runs upwards and forwards to the elevated cornu in the posterior border of the expanded upper portion of the broad ligament.

The relations of the ureters are, in one of these operations, exceedingly important. They are, at full term, detached from the pelvic wall and elevated along with the vagina and bladder. They lie very closely to the vagina on its antero-lateral aspects, and strike the bladder about three-quarters of an inch below the cervico-vaginal junction. These relations are not much changed during labour. As the head descends and fills the parturient canal, the ureters are pushed apart. They now lie in

close contact with the vaginal and uterine walls, amongst the plexus of vessels. The relation of ureter to external os at the end of the first stage of labour—that is to say, at the most important surgical period—is shown in the accompanying diagram, made from a special dissection. (Fig. 95.) In a full

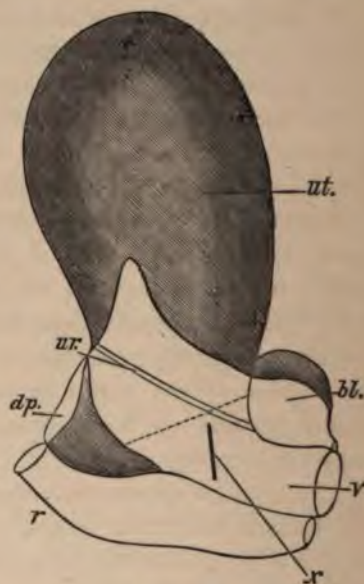


FIG. 95.

Outline drawing from dried preparation of uterus near termination of first stage of labour. (Bristol Infirmary Museum.)

ut., uterus; v., vagina; bl., bladder; r., rectum; d.p., Douglas' pouch; ur., ureter; dotted line at level of external os; x, at line of incision through vagina in Laparo-Elytrotomy. Shading is placed on the areas closely invested by peritoneum.

lateral view, the ureter crosses the line of the os uteri obliquely near the junction of its anterior with its middle third. In other words, at the level of the external os the space between ureter and rectum is twice as great as that between ureter and bladder. The importance of these relations in laparo-elytrotomy will be seen presently. The ureter leaves the uterus behind out of the range of danger in Porro's operation, unless the pedicle is constricted very low down.

Cæsarean Section. Puerperal Hysterotomy.

History.

Operation Described.

Selection of Time.

Instruments.

Parietal Incision.

Opening the Uterus.

Extraction of Fœtus.

Closure of the Uterine Wound.

Modifications of Operation.

History.—The removal of a child from a mother who fails to deliver it is a very old operation. At first performed only when the mother was dead, the operation afterwards came into use while she was still alive. Whether or not we accept the interpretation given to the sentence in Pliny ("Auspiciatus, enecata parente, gignuntur sicut Scipio Africanus prior natus, primusque Cæsarum a cæso matris utero dictus"), there is no doubt that the name Cæsarean was very early given to the operation; and many historical personages—among others, Manilius, Edward VI. of England, and Sanctus, King of Navarre—have been called Cæsars from their having been supposed to be cut out of their mother's womb. According to Heister,* the Greeks were acquainted with the operation of removing the child while the mother was alive, and named it "Hysterotomia." There is little doubt that it was practised among the Jews from very ancient times. In later times, the operation was done here and there; but full and authentic records of it are wanting. The first case recorded with anything like circumstantial minuteness is that done in 1500 by the Châtreur or sow-gelder of Seigerheusen, who operated on his own wife, as recorded by Gaspar Bauhin in his appendix to Roussetus's great work. The woman had been in labour for some days, and had been

* *System of Surgery*, 1750, vol. ii., p. 27.

attended by thirteen midwives and several lithotomists. These the sow-gelder sent about their business, and he extracted the infant with success to both mother and child. W. Simmons, surgeon to the Manchester Infirmary, who published a very able monograph on the subject in 1792, believes that this case was really one of extra-uterine fœtation. Whether this was so we cannot now decide; but the influence of this obscure operator was not felt till after the publication, in 1581, of the first elaborate work on the operation by Roussetus.* By a careful record of seven cases, and an elaborate discussion of all the details of the operation, he sought to place it upon a scientific basis, Bauhin, in 1582, translated this work into Latin, and added an appendix. Guillemeau, Marchant (both Paris surgeons), and others, having utterly failed in the practice of the operation, unhesitatingly condemned it; to these Roussetus, in 1590, replied,† placing the operation on a more secure basis. In 1634, Scipio Mercurius, a Roman surgeon, in his work on *Midwifery*, published in Venice, advises hysterotomy in suitable cases. Soon after this, Schenkus; Roonhuisen, an Amsterdam surgeon; Sonnius, a physician of Bruges; Rudbeckius, a Swede; Bartholini; Renaud; Saviare, and others practised and wrote upon the operation. In 1695 Valerus‡ published a treatise on the operation. Ruleau, a surgeon of Xaintes, seems to have had a successful case about the beginning of the eighteenth century; and Dionis§—who, however, is strongly against the proceeding—by investigations made subsequently on the spot, satisfied himself as to the authenticity of this operation. Sennertus, Fabricius Hildanus, and Scultetus, may be quoted as favouring the operation; Paré, however, was distinctly against it.

A notable contribution both to the history and the science of the subject was made by M. Simon in the first volume of

* *Traité nouveau de l'Hysterotomotomie ou enfantement Césarien, qui est extraction de l'enfant par incision laterale du ventre et matrice de la femme, &c.*

† In *Dialogus pro Casareo partu*, &c., Paris, 1590.

‡ *Dissert. de partu Casareo*, Viteberga, 1695.

§ *A Course of Chirurgical Operations*, Eng. Trans., Lond., 1733, p. 86.

the Memoirs of the Royal Academy of Surgery, in which also various cases are recorded, with not very encouraging success. A similar want of success seems to have followed operation everywhere. In Vienna, Godson tells us, the operation was done for a hundred years without a single success; and in the Maternité, at Paris, a similar story was told. Chiara of Milan gathered 62 operations, with only three recoveries. In England an almost equally dismal record is given for the eighteenth and even part of the nineteenth centuries. Here and there a success is recorded—not always, however, by leaders in surgery, who, as a rule, were opposed to it. One such case is recorded by Mr. Duncan Stewart,* in which a midwife—who seems, however, to have been a consultant among her class—operated successfully with a razor. Unlike most operators, she made her incision in the middle line; she closed the wound with tailors' needles and silk, used like hare-lip pins. The patient was seen afterwards quite well, but with a ventral hernia.

A good many examples of Cæsarean section performed by the patient herself are on record. Among the most remarkable of these is that recorded by von Gugenberg,† where the woman succeeded in removing the child; and all that was left for the surgeon to do was to close the openings. Another ‡—in which the patient, two hours after operating on herself, walked a kilometre, breakfasted with a sister, and then walked about for some time, had protrusion of intestines, and (with medical assistance) recovered—is even more remarkable. More remarkable still are the comparatively numerous recoveries after laceration of the pregnant uterus by the horns of oxen. Amongst fourteen such cases collected by Harris§ only four died, and two of the four dead women left living children; and in four cases both mother and child lived.

The impetus recently given to abdominal surgery has spread to all operations for removing the fœtus, and not least powerfully to Cæsarean section. And, particularly within the last few years,

* *Med. Essays and Observations*, 1752, Edin., vol. v., p. 361.

† *Lancet*, 1886, i., p. 90. ‡ *Lancet*, 1886, i., p. 890.

§ *Abdominal and Uterine Tolerance in Pregnant Women*, Phila., 1892.

the comparative want of success of Porro's operation in Germany and elsewhere has led to the devotion of increased attention to certain details in ordinary hysterotomy which place it in a position of rivalry with, if not of superiority to, hysterectomy.

THE OPERATION OF CÆSAREAN SECTION.

Selection of Time to Operate.—If there is an opportunity of selecting the time to operate, that is, if before the onset of labour a condition has been diagnosed in which Cæsarean section has been decided upon, it is a question whether it is better to wait for the actual onset of labour or not. Almost universally it has been held that the operation should not be performed till labour has begun, but before the escape of the liquor amnii. The physiological results in respect of uterine contraction and the natural evolution of the various acts which complete parturition are then said to be secured for the operation as for the natural delivery. On the other hand, such weighty authorities as Harris and Coe* hold that the chances of success are greater by operating before the onset of labour. They say that the uterus contracts just as well after operation before labour as after labour has set in; that by selecting their own time they can be certain of a deliberate operation during daylight with perfect assistance and surroundings; and that these real advantages more than counterbalance the supposed advantages of operating during labour.

Too often, however, it happens that the surgeon has no election. He is not called in till labour has been in progress for some time, and the natural termination of labour has been proved to be impossible. When it has been decided, in any given case, that puerperal hysterotomy is to be performed, the sooner it is carried out the better. The condition of the patient, already in all probability not very favourable, rapidly deteriorates; and the local effects of prolonged contraction of the uterine fibre, exhausting

* *Amer. Journ. Obstet.*, 1892, xxvi., 4.

its vitality, are not conducive to subsequent healing. Therefore, though it is advisable to operate with a cleansed vagina, no time which delays operation is to be spent in doing this. Cleansing may be carried out after operation is over. The abdomen may be rapidly purified with carbolic or corrosive sublimate lotion, and particular attention must be paid to the umbilicus. Shaving adds to the security. The general arrangements for operation are the same as those already described for abdominal operations in general.

The *instruments* required are very few and simple. A scalpel, a pair of scissors, and a dozen pairs of locking forceps, with the necessary complement of needles, sutures, ligatures, and sponges, are all that are wanted. Two long flat sponges will be found very useful. In every case we ought to be provided with a clamp and other instruments necessary for a possible hysterectomy.

The Parietal Incision.—The abdominal opening, which used to be made to one side of the median line, is now always made along it, and in the same manner as for ovariectomy. But the primary incision is longer, and does not descend so low, while it rises higher. The elevation of the bladder renders it inadvisable to approach within a distance of two or two and a half inches from the pubes. Above this point an incision of five inches may be made. According to the size of the patient, the upper limit will reach to, or pass a varying distance beyond, the umbilicus. In the opinion of Sænger, a suitable incision will in most cases be one-third of its length above the umbilicus, and two-thirds below it. The cut may go straight through the umbilicus; but, for reasons given elsewhere, I think it is better that it should pass to the left of it. If, as some surgeons recommend, the uterus is to be turned out of the wound before opening it, then the incision must be made considerably longer. More will be said on this proceeding. The intention, in the operation to be described, is to give sufficient space—firstly, for removal of the child; and, secondly, for suturing the wound in the uterus.

Opening the Uterus, Extraction of Fœtus.—In making the wound in the uterine walls, we have to bear in mind avoidance of hæmorrhage and the encouragement of subsequent union. If the incision is carried too low, the branches of the uterine artery are endangered. The anterior reflection of the peritoneum from the uterus is a good guide. Here the peritoneum is loosely attached and somewhat freely movable. The lower limit of the incision may enter this region. So far as bleeding is concerned, the upper limits of the incision are unimportant. The position of the placenta might be supposed to have an important influence on the selection of the line for the uterine wound, but, practically, this would seem not to be so. Still, if it is possible to make out the site of the attachment of the placenta before incising the uterus (always difficult, often impossible according to most writers), the operation might be rendered easier by avoiding this area. No extraordinary trouble need be taken to avoid it, however. A vertical incision is recommended.

The line of incision being fixed upon, two long flat sponges are placed, one on each side of it, between the uterus and the parietes. An assistant, standing on the left side of the patient, opposite to the surgeon, places a hand deeply in each flank behind the uterus, and makes the uterus bulge forward into the parietal opening, firmly holding it there. By this manœuvre, and with the intervention of the flat sponges, the risks of escape of fluids into the abdomen are minimised. The uterus is so placed and fixed that the incision through its walls will correspond to the parietal incision.

As to the best mode of making the uterine incision, many opinions are held. Some recommend tearing; others, a combination of cutting and tearing; others, pure cutting. Some recommend a dissection deliberately carried out, each vessel being caught in forceps as it bleeds. To prevent bleeding, the placing of a temporary ligature around the neck of the uterus has been used by several surgeons; by others, equally trustworthy, it has been neglected. Murdoch Cameron* has successfully used and speaks highly of the pressure of a ring pessary around the uterine

* *Brit. Med. Journ.*, 1892, vol. ii., p. 1383.

incision. As a matter of fact, the bleeding is rarely severe; but should it chance to be alarming, a sponge may be packed into the wound to check it while the elastic ligature is slipped over the uterus to its neck and tightened. In the absence of a proper tourniquet, a simple knot may be cast and tightened; while it can easily be prevented from becoming undone by placing a catch forceps upon it. In every case it is best to do without the use of a constricting ligature, if that is possible; every increase of traumatism adds to the danger.

I am in favour of a clean-cut incision. At the upper end of the projected incision, where the uterus is least vascular, an opening an inch in length is rapidly made by the scalpel. The opening need not completely perforate the uterine walls, but may be completed by pushing the finger through it. If the membranes are intact, a condition which is considered favourable, they need not now be divided; but it can matter little if they are divided by the finger. The incision is now rapidly completed downwards, by scissors cutting on the finger as a director. A few seconds suffice for this part of the proceeding. The scissors is now thrown aside, and the hand plunged through the opening catches the head of the child, the fingers clipping the neck. If the feet are conveniently near, the child may be extracted by grasping them; but as the uterine opening may contract round the following neck, it is better to extract by the head. If, during extraction by the feet, the head is caught in the uterine opening, the incision should be prolonged upwards to prevent downward laceration of the uterine walls.

Uterine action will have been going on all this time, and gushes of amniotic fluid will have escaped from the uterus and run over the macintosh plastered round the abdominal opening. The assistant, meanwhile, will have carefully kept the uterus pressed forward on to the abdominal walls: if he is skilled and attentive, no fluids will enter the abdomen.

The umbilical cord is now divided between two pairs of locking forceps, and the child is handed over to an assistant. The surgeon then directs his attention to the detachment of the placenta, and the bleeding in the uterine wound.

If the uterus is contracting well, bleeding from the uterine sinuses soon ceases, and the placenta becomes spontaneously detached. At least one surgeon seems to have been able to increase the vigour of uterine contraction by the application of electricity, and this hint is well worthy of attention. A hypodermic injection of ergotine is advisable at this stage. If the condition of the patient permits of it, it is always best to wait for spontaneous detachment of the placenta. During this period it is easy enough to control bleeding from the uterine sinuses by compression by sponges, or, if necessary, by forceps. If, after a timely delay, the placenta is not detached, we may encourage detachment with the fingers; but if the uterus still refuses to contract, and if bleeding continues free from the uterine incision, then we ought to proceed to hysterectomy by Porro's method. The secret of success in simple hysterotomy is efficient contraction of the uterus; if this fails us, the next best proceeding is hysterectomy.

In the great majority of cases, operated upon sufficiently early, the uterus contracts, the placenta is spontaneously detached, and the hæmorrhage from the uterine sinuses spontaneously ceases, or becomes unimportant. Careful attention is bestowed on the complete and thorough removal of the secundines. When the uterus is empty, it may be advisable to push a drainage tube or probang through the cervix and vagina, and leave it there to act as a drain. In any case permeability towards the vagina will have been ascertained before closure of the uterine wound is begun. There is little use in mopping out the uterine cavity; it soon refills. Generally speaking, the less manipulation the better; the process of parturition physiologically looks after itself; meddling interference means, in many cases, harmful traumatism.

If the uterus has contracted well, and seems to be small enough easily to be pushed by the assistant through the parietal opening, there is no strong objection to this being done. It prevents the escape of blood into the cavity during the extraction of the placenta, and facilitates the insertion of sutures. Most surgeons would, however, dread the risks from additional traumatism thus induced.

Closure of the Uterine Wound.—There is a very general consensus of opinion that on this detail, more than on any other, depends the success of Cæsarean section. No doubt this is so. But many cases of recovery are on record in which no closure has been attempted; the wound has been left to close by uterine contraction. On the other hand, it would seem that if uterine contraction fails, mere suturing is not always sufficient. Accurate suturing, *plus* uterine contraction, gives the best results.

The problem is complicated. The natural involution of the uterus induces an atrophy of uterine fibres, which is degenerative and attended with the free discharge of fluids. This process is, in wounds of uterine tissue proper, strongly prejudicial to union by adhesive inflammation. Uterine contraction going on after delivery, means that a condition of unrest exists in the uterine wound. This is another bar to union. And this unrest and the delayed union permit of the escape of intra-uterine fluids through the wound into the peritoneum—a contingency which is full of danger.

The methods of suturing the uterine wound are very numerous. Lebas, in 1769, first introduced sutures. Polin of Kentucky in 1852 first introduced the silver suture; and this has always been a favourite material. Hemp, catgut, silk, and other materials, have been used; and the sutures have been placed in a great number of ways—deep, superficial, continuous, interrupted, singly, and in combinations. Wells, in a successful case, used a continuous silk suture, one end of which he carried through the vagina, subsequently removing it by traction. But the success after any method was not encouraging.

Within the past few years special attention has been devoted by several German surgeons to the mode of suturing the uterine wound, and with a success which is remarkable and striking. The extraordinary capacity of serous surfaces to become quickly glued together by inflammatory adhesions had been fully proved in abdominal surgery. In gastrostomy, enterotomy, and enterectomy, it had been shown that apposition of serous surfaces, with fixation by suitable and numerous sutures, was followed by agglutination so intimate and strong that escape of fluids or gases was impos-

sible. The danger in Cæsarean section arose from gaping of the uterine wound, which took place from the natural shrinkage of the uterine fibre. As the fibres shrank the sutures became loose; and they might even act as setons, encouraging the escape of uterine secretions. The principle of the new improvement was, to look to the peritoneum for the perfect closure of the uterine wound towards the abdomen.

Though Van Aubel is said to have suggested this method in 1862, Säger, who published his ideas in 1882,* deserves the chief merit of having introduced it. Leopold was the first actually to carry it out. Beumer, Obermann, Münster, Credé, and others soon followed; and the combined results of these operators, in the short time during which they have been working, have already placed the improved mode of Cæsarean section by the conservative Säger or Säger-Leopold method ahead of all others.

Many variations in detail have been given. Säger at first recommended resection of a wedge-shaped strip of muscular fibre under the peritoneal covering, so as to permit of the infolding of a greater amount of serous surface. This was found to be unnecessary, and sometimes even harmful. It is usually possible, without resection of muscular tissue, to fold inwards sufficient breadth of serous surface. It is unnecessary to recapitulate every variety of suture which has been employed; I select one which seems the best.

A double row of sutures is used, deep and superficial. (Fig. 95.) The peritoneal covering is detached from the muscular fibre for a little distance along the margins of the wound: in this way, it is possible to turn inwards a greater surface of peritoneum. Then the deep sutures are placed. They are made to enter at about half an inch from the edge of the wound, passed obliquely through uterine tissue, and made to emerge near to the bottom of the cut surface. No suture should enter the uterine cavity. These deep sutures should be placed about three-quarters of an inch apart; and they should be carried, converging a little, beyond the ends of the incision.

Then the superficial sutures are placed, two between each deep

* *Der Kaiserschnitt*, &c., Leipzig, 1882.

suture. The needle first pierces peritoneum and muscle, coming out a little below the lip of the wound; then it picks up the free edge of the peritoneum on its own side, and finally pursues the same course in opposite direction with the other side. The diagram (Fig. 96), after Säger, shows this more clearly than

any description.

The sutures are placed with great care, and they are carried a little way beyond the extremities of the wound.

The superficial sutures are first tied, bringing into accurate apposition two strips of peritoneum. Then the deep sutures are tied, causing still further incurvation of serous surfaces, and closing up and strengthening the whole. Finally,

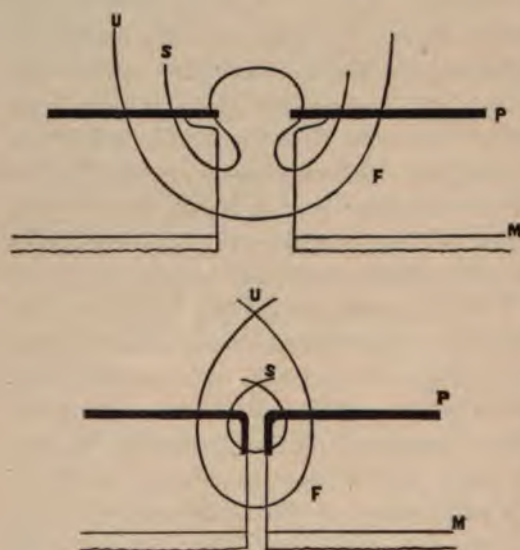


FIG. 96.

Diagrams to show the placing of Sutures in the Uterine Wound after Cæsarean Section.

P, Peritoneum; F, Uterine Fibre; M, Mucous or Decidual Layer; U, Deep Uterine Suture; S, Superficial Serous Suture.

if apposition does not seem to be perfect, a simple continuous suture may be inserted over the whole.

In every case where future pregnancies may take place this should be prevented by excising with scissors a small portion of each Fallopian tube.

While the sutures are being inserted, a few sponges placed in Douglas's pouch and around the uterus will absorb any fluids that may have escaped. These are now removed, and the whole cavity cleansed.

The wound in the parietes is sutured in the ordinary manner.

The question of drainage is not without importance. In most cases it will be useless; but in some, by giving timely warning of the escape of uterine fluids, it may prove invaluable. At the worst it is harmless, and therefore I should always insert a drainage tube. It need not go deeply into the pelvis. A piece of rubber tubing, cut obliquely, laid over the uterine wound, and fixed by a stitch into the lower angle of the parietal incision, will suffice. At the end of a day or two it may be removed, should it not be required.

If the patient survives the shock of the operation, the chief subsequent danger is from peritonitis. This is treated according to ordinary principles by turpentine enemata and saline purges. But such peritonitis will almost certainly have been produced by extravasation of uterine secretions, and for this the best treatment is free drainage and frequent irrigation. At the same time cleansing of the vagina and of the cavity of the uterus by warm antiseptic fluids must be instituted. If there is evidence of gaping of the uterine wound, the abdominal incision may be re-opened, and an attempt made to close it. If the patient will bear it, hysterectomy even might be contemplated as a last resource.

Modifications.—A few of the most important modifications may be referred to.

Kehrer of Heidelberg* recommends that the uterus be opened at the level of the internal os by a transverse incision. By this method he thinks that the wound is less liable to gape, that the placenta is less likely to be in the way, that the head is more easily reached, and that the peritoneum, being here loosely attached to the uterus, is more easily sutured separately. He recommends vaginal as well as abdominal drainage. He lost three cases in seven operations, and his plan has not secured followers. Obvious objections are: danger of hæmorrhage, the wound being in the region of large vessels; difficulty in control-

* *Archiv. f. Gynäk.*, bd. xix., heft. 2.

ing it by temporary ligature, should it occur; and risk of circular tearing in extracting the child.

Cohnstein* recommended that the whole uterus should be turned out of the abdominal wound, and that the opening should be made on its posterior aspect while the aorta is being compressed. He advised drainage through Douglas's pouch, and complete closure of the abdominal wound. He rests the advantage of his plan on the facts, that the uterine tissue is thickest behind, and therefore less likely to gape; and that the posterior opening and dependent drainage are the best safeguards against septic peritonitis. His plan has not been adopted.

Sänger† himself recommended the long abdominal incision, and delivery of the uterus before extracting the fœtus. A few sutures are at once placed in the upper end of the incision, to prevent extrusion of bowels, while the abdominal cavity is shut off by placing a sheet of caoutchouc under the uterus over the abdominal wall. The evident disadvantages of this plan probably outweigh the advantages.

Frank‡ has ingeniously suggested that the vesico-uterine pouch should be closed as far as possible by stitching the round ligaments together, and draining the hollow thus formed through the wound. The use of a short rubber tube in the manner I have suggested, secures this advantage by a simpler method.

* *Centralbl. f. Gynäk.*, bd. v., heft. 12. † *Archiv. f. Gynäk.* bd. xix., heft. 3, s. 397.

‡ *Centralbl. f. Gynäk.*, bd. v., heft. 25, s. 598.

Porro's Operation. Puerperal Hystarectomy.

History.

Operation Described.

Parietal Incision.

Uterine Opening.

Management of Placenta.

Control of Hæmorrhage.

Amputation of Uterus.

Treatment of Pedicle.

Dressing.

After-Treatment.

History.—Removal of the uterus, as a sequel to Cæsarean section, was first deliberately planned and carried out by Porro, in the Maternity Hospital of Pavia, in 1876. His patient was a woman deformed by rickets; and, although puerperal fever was then prevalent in the hospital, an excellent recovery followed. The idea was suggested by the success of hysterectomy for fibroids, and was strengthened by the results of experiments upon animals. Since then the operation has been known by Porro's name.

According to Godson,* the possibility of removing the gravid uterus from animals was first proved, in 1768, by Cavallini in Florence. In 1828 Blundell of Guy's Hospital performed the same operation on four bitches, with three successes, and suggested that hysterectomy might be a wise practice after Cæsarean section, or when a patient is evidently sinking after rupture of the womb. Michaëlis of Marbourg, in 1809, made a like suggestion; and other workers added to the experimental proofs of the possibility of operating with success.

The first case of actual removal of the gravid uterus in a woman was in the hands of Horatio Storer of Boston in 1869. He performed hysterectomy to avoid death from uncontrollable

* *Brit. Med. Journ.*, 1884, i., p. 142.

hæmorrhage in Cæsarean section. The patient died in sixty-eight hours. After Porro's own operation, the next success was secured by Späth of Vienna, in 1877. Since then the operation has been performed more than 250 times, with a per-centage of women saved of something between 40 and 50.

THE OPERATION.

Porro's operation may be defined as Cæsarean section, followed by removal of the uterus at the cervical junction, along with the ovaries and oviducts. It has been variously named—Cæsarean hyster-oöphorectomy, Cæsarean hyster-o-variectomy, puerperal hysterectomy: Porro himself described it as "Utero-ovarian amputation, as a mode of completing the Cæsarean section." A true Porro's operation is therefore always preceded by Cæsarean section. In his proceeding also the fœtus is supposed to be viable. But puerperal hysterectomy may be performed for ruptured uterus, and for abnormal conditions which exist before the end of pregnancy: it is necessary to separate these from true Porro operations. Godson, in his valuable paper, very properly tabulates the operations into:

1. True Porro operations.
2. Utero-ovarian amputations performed during pregnancy, but before the fœtus was viable.
3. Operations for removal of the fœtus from the abdominal cavity by coeliotomy, followed by amputation of ruptured uterus with ovaries.

For each of these proceedings the operative details are, in their main features, identical. Some special remarks will, however, be necessary in describing the operation for ruptured uterus.

The Parietal Incision is the same as for simple Cæsarean section. If anything, it ought to be lower, because the stump of the amputated uterus has to be brought out at its lower end. A modification introduced by Müller in 1878, whereby the whole

uterus is turned out of the abdomen before it is opened, necessitates a very long incision. The advantages claimed for this method are, that it avoids the risk of escape of uterine fluids into the abdomen (a real advantage if, as in his case, the fœtus is putrid), and that it renders easy the application of a temporary constrictor to prevent hæmorrhage. The evident disadvantages are, however, so great that Müller's modification has not received much support.

The Uterine Opening may be made by incision or by tearing, and may be directed transversely or longitudinally. As the uterus is to be amputated, and the uterine wound is not to be closed, the mode of opening is not so important in Porro's operation as it is in true Cæsarean section. The selection of a site for making the opening may, within certain limits, be guided by the position of the placenta.

Godson favours a transverse opening low down, made by tearing. Most operators, however, prefer a vertical opening, made by cutting; and this method seems, on the whole, to be the best. The incision may be rapidly made by scissors, in the manner recommended for Cæsarean section.

Other details as to the placing of sponges, pressing forward the uterus and delivering the child, are the same as for that operation. The cord is divided between compression forceps, and the child handed over to an assistant.

Management of the Placenta.—The placenta may or may not be removed before amputating the uterus. The only advantage of so removing it is, that the uterus is thereby diminished in size; the disadvantages are, waste of time and risk of bleeding. Experience has proved that it is, at least, unnecessary; practically, therefore, it may be left attached.

Control of Hæmorrhage from the uterus may be effected by temporary constriction round the neck, by the hand inserted into the abdominal cavity, or by an elastic ligature, or by an instrument such as Tait's rope constrictor. Large T-shaped

compression forceps applied to the edges of the uterine wound would quickly and efficiently serve the same purpose. But, with moderate uterine contraction and due rapidity of operation, bleeding from the uterine wound may be ignored—at least, till the uterus is turned out of the abdomen.

The uterus is delivered by hooking the forefinger of each hand into the ends of the incision and dragging it forwards. The abdominal cavity is shut off by placing large sponges in the opening.

Amputation of Uterus. Treatment of Pedicle.—Thus far experience has declared strongly in favour of the extra-peritoneal treatment of the pedicle. According to Godson's tables, of fifteen cases treated by intra-peritoneal methods, eleven died. Though the verdict thus given cannot be regarded as final, it may safely be concluded that, with the practical methods at present in vogue, the likelihood of success is greater with the extra-peritoneal than with the intra-peritoneal method.

Numerous methods of constricting the pedicle have been employed. Various forms of wire constrictors and chain ecraseurs; the wire ligature, singly or in sections; steel clamps; and the elastic ligature, have been used. Constriction by a wire which can be tightened has been most favoured, and has given the best results. Cintrat's constrictor has most often been employed; but Koeberlé's simpler and smaller instrument is gradually displacing it. Tait's recent modification of Koeberlé's *serre-nœud* (Fig. 78) is as nearly perfect as such an instrument can be; and this instrument I consider the most suitable for securing the pedicle in puerperal hysterectomy.

The instruction generally given is, to place the wire round the neck of the uterus at the level of the internal os. But the position of the internal os will vary according to the stage of labour and the subsequent degree of uterine contraction. It will generally be safe to place the wire immediately below the bulge of the uterine walls, which marks the lowest descent of the foetus. In the later stages of labour this will be very near to the level of the external os. In cases necessitating opera-

tion, there will be some obstruction to the descent of the fœtus, and as the uterus contracts the os is of necessity dragged up over the fœtus. The ureters can scarcely be endangered. If a temporary constrictor has been put on, the wire is placed below it, if this does not involve too low a situation; but there is no strong reason why the wire should not be placed in the groove of the temporary constrictor, or even above it. The single wire is quite sufficient: extra ligatures of silk or other material are useless, and may act simply as traps for filth. The instrument is fixed so that the handle shall be at right angles to the wound, or turned a little upwards towards the umbilicus. In this position it is least in the way of catheterism, or dressing of wound or pedicle.

To fix the pedicle in the wound, and to prevent its retraction, one or two round steel pins are passed through it above the site of constriction. The pins are identical with those used in hysterectomy for fibroids, and their ends are protected in the same way.

The uterus being cut off at a distance of about three-quarters of an inch above the wire, the pedicle is carefully placed in the bottom of the abdominal incision. Before this is done, the vesico-uterine cul-de-sac is cleansed with a sponge, and the peritoneum around the pedicle and covering Douglas's pouch is also cleansed. Some surgeons, with a view to getting as rapid and complete closure of the peritoneum around the pedicle as possible, recommend that the parietal peritoneum at the lower extremity of the wound should be fixed to the peritoneum surrounding the pedicle. This is not necessary: the parietal peritoneum should be placed as low down on the pedicle as possible; but it need not be inverted or sutured. The pedicle is arranged exactly as in hysterectomy for fibroids.

The lowest suture in the abdominal wound is so placed that it brings the cut edges in close apposition to the pedicle, but not with undue tension. Tension will cause suppuration around the suture, an event specially to be guarded against. The rest of the sutures are placed in the ordinary way.

Except in very special cases, drainage is not called for.

The pedicle is now finally trimmed and dressed. With scissors any superfluous tissue is cut off, leaving a circular convex surface, even all round. The mucous membrane in the centre, being prone to decompose, is scraped out, and the cavity cleansed. To mummify the tissue destined to slough beyond the constricting wire, perchloride of iron is rubbed into the raw surface, either solid or in a concentrated solution in glycerine. This, however, may safely be omitted: simple absorbent wool is quite efficient as a desiccator; boracic powder rubbed into the incised surface will keep the parts sweet. Pieces of lint are carefully packed around the base of the pedicle, so that no discharges shall get inside the abdominal cavity.

The dressing of the wound is most conveniently carried out in two parts. The upper part, the parietal wound, is dressed as if for primary union, with a dressing that need not be disturbed for a week. The part in which the pedicle lies is so covered that a discharge of blood will be at once visible, and the screw of the clamp reached without disturbing the upper dressing. Further, the pedicle, undergoing decomposition, ought to be kept apart from the healing wound, and constantly under the influence of active antiseptics. With the help of antiseptics, it sometimes happens that from beginning to end the pedicle is kept sweet, even if it does not continue dry: this is an advantage that cannot always be counted upon, however. All around the root of the pedicle small pledgets of boric lint or absorbent gauze are packed, and removed as often as may be necessary.

The wire of the *serre-nœud* is usually tightened a little every day or every few days, as may seem expedient. At the end of a week or a fortnight, it will come away with the strangulated tissue above it. It is doubtful, however, whether this daily tightening of the pedicle really promotes separation of the slough. For reasons given under the head of hysterectomy for fibroids I recommend and practise no tightening of the constrictor, and completely remove it from the third to the fifth day.

The *after-treatment* requires no special comment. Peritonitis,

simple or septic, is the chief cause of death, accounting for half the mortality. To obviate this an empty state of the bowels is the best treatment. Turpentine enemias, and, as soon as the patient will bear it, a saline aperient, ought to be given. Marked symptoms of peritonitis ought to be promptly met by abdominal drainage and irrigation through the wound above the pedicle. Rectal alimentation and free stimulation will be necessary, particularly if there is sickness.

Laparo-Elytrotomy.

History.

Operation Described.

Preliminary Steps.

Assistance.

Parietal Incision.

Vaginal Opening.

Delivery of Child.

Cleansing, Suturing.

Dressing.

By this operation (*λαπάρα*—flank; *ἐλκτρον*—vagina) is meant removal of a foetus through incisions in the abdominal wall and in the vagina, without opening the peritoneum or wounding the uterus. It is also known as Gastro-elytrotomy and as Thomas's operation.

History.—This operation is as much the property of Gaillard Thomas of New York, as is the operation just described of Porro. Like the latter operation, laparo-elytrotomy had been proposed and even carried out, after a fashion, years before Thomas re-introduced it. According to Mangiagalli,* Joerg† in 1806 suggested the plausibility of reaching the uterus through an abdomino-vaginal incision; but there is no evidence that he ever operated. In 1820, Ritgen,‡ on hearing of the plan of ligating the external iliac without entering the peritoneum, devised gastro-elytrotomy for removal of the foetus from the uterus. He operated in 1821; but the bleeding was so free that he had to conclude with an ordinary Cæsarean section. The patient died of vaginal hæmorrhage. Baudelocque (1823) seems to have devised no fewer than six methods, of which he tried two, both without success. Physick (1824) proposed a

* "Le piu recenti Mod. del Taglio Cesareo," *Am. Journ. Med. Sc.*, 1884, lxxxviii., p. 231.

† *Handbuch der Geburtshülfe*, 1807. Garrigues.

‡ *Heidelberg Klinische Annalen*, vol. i., 1825, p. 226.

somewhat similar proceeding, reaching the uterus by a horizontal incision over the top of the bladder and under the peritoneum; but he never put it into practice. Sir Charles Bell (1837) discussed the method of sub-peritoneal hysterectomy, and suggested digital laceration of the vagina to avoid hæmorrhage; but it is doubtful if his proposal was original.

The operation owes its revival, and indeed its present existence, to Thomas. His proceeding, that of Ritgen and Bell combined, was carried out by him in March, 1870, on a living, or rather a dying, woman.* The patient was at the end of the seventh month of gestation, and was *in articulo mortis* from pneumonia; the operation was undertaken solely in the interests of the child. This case proved the feasibility of the operation. Dr. Skene† and others took it up, and have secured to it a promising degree of success.

THE OPERATION.

Dr. H. J. Garrigues, of New York, has devoted special study to the history and technique of the operation, and has minutely described the anatomy of the parts.‡ To him and to Harris of Philadelphia, as well as to Thomas himself, I am mainly indebted for the following description.

Preliminary Steps.—The patient is prepared in the ordinary way by clearing the *primæ viæ*; the parts are thoroughly cleansed, the pubes shaved, and the vagina and vulva purified. The pelvis is elevated by a hard cushion, and the thighs are extended as much as possible. The os uteri, if not fully dilated, is now dilated artificially by means of Barnes's bags, or, if necessary, by the fingers.

Assistance.—Four assistants are desirable. The operator stands on the right of the patient. One assistant is placed on the left side; his duty is to pull the fundus backwards and

* *Am. Journ. Obstet.*, May, 1870. † *Am. Journ. Obstet.*, Oct., 1887.

‡ *New York Med. Journ.*, Oct. and Nov., 1878.

towards the left, so tilting the lower end of the uterus forwards and towards the right, and making tense the skin in the right groin. A second assistant, standing on the right side and to the operator's left, keeps open the wound in the groin by pressing his hand into its upper edge, and drags the peritoneum and bowels upwards. A third assistant passes a catheter into the bladder, and manipulates it according to direction. The fourth assistant helps in various ways, chiefly by pushing the vagina into the wound, and in manipulating the thermo-cautery should it be called for.

The Parietal Incision is made in the right inguinal region, which has a slight advantage over the left in being more remote from the rectum. It is slightly curved, concavity upwards, and runs parallel with Poupart's ligament, about an inch above it. It begins an inch and three-quarters above and to the outside of the spine of the pubes, and ends an inch above the anterior superior spine of the ilium. The incision thus escapes the internal epigastric artery and the round ligament on the inside; it divides the external epigastric. The external oblique muscle is divided through its aponeurosis, except just above the iliac spine, where muscular fibres are met with. The fibres of the internal oblique being parallel to the incision, are simply separated; the fibres of the transversalis descending a little, require division. The transversalis fascia is now reached and carefully divided, after being pinched up between forceps. The fingers now push upwards the peritoneum and sub-peritoneal fat, and slowly work downwards towards the vagina, which is meanwhile tilted upwards and to the right by the assistant manipulating the fundus. The circumflex iliac is below the incision and out of the way. The elevated and loosely attached peritoneum is easily pushed aside and kept out of the way by the assistant behind the operator, using the palms of his hands covered by linen rags wrung out of warm carbolic lotion. A straight silver catheter is now passed into the bladder by the third assistant, and its tip made to bulge at the vesico-vaginal junction on the right side, so as to mark the proximity of bladder and ureter.

The Vaginal Opening.—At the end of pregnancy, in cases of narrowed diameter, the whole of the uterus will lie above the brim; and during labour, as the head cannot descend, the vagina will be dragged upwards. Near the utero-vaginal junction vessels are most abundant; it is therefore advisable to make the opening in the vagina as low down as possible. The vaginal branch of the uterine artery at the side of the vagina, and the ureters and base of the bladder in front, leave the antero-lateral aspect of the vagina as the most eligible site for making the opening. The ureter and base of the bladder lie most dangerously near, almost in the field of operation. Roughly speaking, the ureter enters the bladder an inch below the level of the external os in the later stages of pregnancy; and during labour in the normal state, shown in the dissection which I have made (Fig. 95), the relations are not much disturbed. From its entrance into the base of the bladder, a position which may be demonstrated by the catheter, the ureter crosses over the vagina obliquely upwards and backwards. The site of election ought to be at least an inch and a half below the level of the tip of the catheter, lower if possible, and a clear inch from the lateral margin of the bladder.

The vagina may be pushed into the wound in various ways. Garrigues recommends for this purpose a blunt wooden instrument, something like the obturator of a cylindrical speculum; and he directs that the incision should be made on this instrument as low down as possible, away from the uterus, and parallel to the catheter in the bladder. Thomas, in his first case, used a steel sound; in his second case, the finger of an assistant pushed up the vagina. Skene used his own finger.

The advantage of using the wooden obturator is, that the parts may be divided on it by the cautery; the disadvantage is, that the division is made without the diagnostic aid of touch. Probably as good a plan as any would be that the operator should push the vagina into the wound by the first and second fingers of the right hand, and with the left hand push a Lister's sinus forceps through the vagina between them. Dilating the blades sufficiently to admit the two fingers of the right hand,

the surgeon may enlarge the opening by tearing with the fingers inside and outside the vagina. The direction which the rent tends to pursue must be observed; as far as possible, it is guided downwards and backwards, away from bladder and ureter. It is not, however, at this stage that these parts are in most danger; but later, during the extraction of the child.

Delivery of the Child.—The catheter is withdrawn, and steps are now taken to extract the fœtus. The finger is hooked into the os uteri, pulling it towards the wound. If dilatation is not sufficiently advanced, this is artificially encouraged by the fingers. The membranes are ruptured; the long axis of the uterus, by combined depression of the fundus and elevation of the cervix, is brought as far as possible in a line with the opening in the flank; and the child is delivered by forceps, or turning, as seems at the time most suitable. The placenta is expelled by pressure.

The child is handed to an assistant, and attention directed to the wound. Firstly, all bleeding must be checked. The edges of the vaginal rent are examined carefully, and ligatures placed on bleeding points. A large sponge placed high up in the vagina may be of service in pushing the parts into the wound. Thornton's T-shaped forceps may be found of value in checking oozing over considerable areas. Temporary forcipressure may be found of conspicuous advantage. The application of the actual cautery through a vaginal speculum may be required. As a last resource, sponge packing from vagina and from wound with firm pressure by bandages may be used.

Finally, the safety of the bladder and ureter must be ascertained. If the ureter cannot be seen, it is probably intact. A rent in the bladder may easily be overlooked; the best way to detect it is to inject coloured fluid through the urethra.

Cleansing, Suturing, and Dressing.—The wounds are thoroughly cleansed by irrigation and sponging; iodoform powder is blown into the deep parts, and one or two large drainage tubes are passed through the vaginal opening into the wound in the loin, and out to the abdominal surface.

The parietal wound is closed in the ordinary way. If the abdomen is compressed by a binder the peritoneum will fall down into its natural position, and the gaping wound will fall together. If necessary, irrigation may be carried out through the drainage tubes.

The dressings over the flank may be of any antiseptic and absorbent material. On the vaginal aspect most scrupulous cleanliness must be observed. Packing the vagina with dressings is irritating to the patient, and liable to cause disturbance of parts. Dressings packed between the labia and around the external parts will be found efficient. The urine should be drawn at each dressing, three or four times daily; the external parts ought then to be cleansed most thoroughly, and smeared with an antiseptic material, such as boro-glyceride; and a fresh dressing applied, and retained by a T bandage. A large drainage tube in the vagina will facilitate the outflow of the discharges.

Comparative Survey of the Cæsarean, Porro's, and Thomas's Operations.

It will be of advantage to consider in conjunction certain facts and theories which are common to these modes of operative delivery. Though I believe that, in some degree, each operation has special indications, yet in many cases the choice, *quâ* operation, is evenly balanced; that is to say, a surgeon would be fully justified in selecting any one of them. Symphysiotomy is not a competitor with these operations, but rather with embryotomy.

INDICATIONS TO OPERATE.

In a general way the indications to Cæsarean section are the indications to Porro's and to Thomas's operations.

The most frequent indication is deformity of the pelvis, with contraction of its diameters. The operation is said to be justifiable when the contraction is so great that we cannot expect to deliver the fœtus *per vias naturales*, with or without embryotomy, and save the mother. The degree of contraction is generally stated as $1\frac{1}{2}$ inch and below. But cases in which much distortion exists may have an upward limit of 2 inches.

Tumours of various sorts may so block the pelvic outlet that delivery is impossible. Ovarian and uterine growths of all sorts, enchondromatous and other tumours springing from the pelvic bones, and even tumours springing from the abdominal organs, as the kidney or liver, may cause the obstruction.

Malignant disease of the cervix, if far advanced, may be an indication for operation. Before the child is viable, removal of the whole uterus may be instituted; but this proceeding comes under a different category.

Impaction of the fœtus transversely across the pelvic brim may, under special conditions, be considered an indication. According to Harris,* seven out of eleven cases of Cæsarean section for impaction were saved.

* *Internat. Cyc. Surg.* vol. vi., p. 762.

MORTALITY STATISTICS.

Simple Cæsarean.—To get at trustworthy statistics of the results of the old Cæsarean operation is impossible. Mayer's statistics of the results in England, Germany, France, Belgium, Italy, and America give 1605 operations, with 54 per cent. of recoveries. The infant recoveries are between 50 and 60 per cent. Radford's table of operations in Great Britain gives 131 cases, with only 23 recoveries. In America, Harris gives 124 operations, with 53 recoveries; and other writers give a per-centage of recoveries, in America, of about 42 per cent. Against these statistics we must place the authorised statements that in certain hospitals in Paris, Berlin, and Vienna, not a single success had been scored for many years. Too ready deductions have been made from such statements: the operation is not uniformly fatal; or fatal in anything like 99 per cent. of all cases. The greatest success has always attended the operation in country districts. But on the other hand, it is certain that the general statistics of results are too favourable. A fair estimate would probably be between 75 and 80 per cent. of deaths in all cases operated on by the old Cæsarean method.

The Improved Cæsarean.—The results of the new Cæsarean operation are so favourable that it must replace the old. Up to 1890, according to Harris,* 153 Säger-Leopold operations had been performed in eleven countries, with a mortality of 29 per cent. Credé records 23 cases, with 4 deaths. Twenty operations in the Dresden Institution had only two deaths, and all the children were saved; six at the Leipzig clinic were all successful. In Germany, the general mortality over 75 operations is only 14.7 per cent. In 1886 there were 22 operations, with 4 deaths. In 1887-88, with 93 operations, the mortality was 25 per cent.; so that it has not improved so much in proportion as Porro's operation. In a more recent communication, Harris† states that between 1880 and 1891, Säger got the remarkable results, after 35 operations, of only 2 maternal and 2 foetal deaths. Zweifel

* Personal communication. † *Amer. Journ. Med. Sc.*, 1891, cli., p. 371.

lost only 1 patient in 18 operations. The operation, therefore, in good hands, is steadily improving in success, and may claim a death-rate of not more than 15 per cent.

Porro's Operation.—The most complete Porro - Cæsarean statistics are published in the *American Journal of the Medical Sciences* of April, 1885. They continue Godson's table, and include other cases. The total is 164. Porro's method, unmodified, was employed in 109 of these, and 46 patients recovered. The Porro-Müller modification was employed in 41 cases, with 21 recoveries. Veit's intra-peritoneal method of treating the stump was followed in 14 cases, with 4 recoveries. Excluding moribund cases, and including only such as may be legitimately described as Porro-Cæsarean, we have a total of 147 operations, with 65 recoveries—a per-centage of women saved of 44. In special institutions and in the hands of special operators better results are got. Braun in 12 cases had 8 recoveries. Fehling had 1 death in 4 cases; he puts the general mortality of the Porro-Cæsarean operation at 58.8 per cent. Harris's latest statistics* give 250 operations in fifteen countries, with a mortality of 46 per cent. In 1885-86-87-88 there have been 79 operations, with a mortality of 19 per cent.—a very decided improvement, if it is true. Curiously, the results of the improved Cæsarean are best in Germany; while Porro's operation has best results in England. I am inclined to believe that this may arise from earlier operation on the Continent than with us.

Laparo-Elytrotony.—So far as I can discover, only 14 of these operations have been performed, with 7 maternal recoveries. Of these, Skene of Brooklyn has had 4 cases, with 3 recoveries. From this small number no conclusions can be drawn. It should be noted, however, that nearly all the deaths were in very unfavourable cases. On the other hand, one of the successes was secured by Dr. McKim,† under circumstances almost as unfavourable as it is possible to conceive.

In every case it must be remembered that delay in operation

* Personal communication. † *N. York Med. Journ.*, 1887, xlvii., p. 651.

is one of the most potent factors in causing failure. Statistics show this very markedly. Operation at full term before labour has set in cannot fairly be compared with operation at the end of an exhausting labour, complicated perhaps with instrumental proceedings. At present the operation has fallen into disuse: whether this is deserved or not time will show.

PECULIARITIES AND RESULTS OF EACH OPERATION.

In seeking to form a fair comparison of the relative values of these operations, many circumstances must be taken into consideration. Among these the most important are: the facility of the operation; the nature of the immediate risks as to shock, bleeding, and peritonitis; and the character of the remote effects.

The Operation.—From the nature of the case, many operations have to be suddenly performed by practitioners not specially trained, with an inadequate supply of instruments, and at a distance from skilled assistance. In such cases the classical Cæsarean operation will almost certainly be selected. In every case, however, the improved suturing of the uterine wound ought to be carried out.

In other circumstances, where the full advantages of trained assistance, suitable instruments, and some experience, are available, it is not easy to decide, from the operator's standpoint, which is the most promising.

Of laparo-elytrotomy, all who have performed the operation say that it is easier than Cæsarean section, that it presents no special difficulties, and requires no special instruments. From the fact that Skene was able to finish one operation in fifteen minutes, and another in ten, it is evident that the technique is not elaborate or difficult. The greatest risk is rupture of the bladder: this happened in five of the cases, but the rent healed spontaneously in all. Bleeding has given little trouble. Pelvic cellulitis is to be apprehended from the extensive opening up of

fibrous layers and bruising of parts; and a somewhat prolonged suppuration is to be expected. The immediate dangers are over when the vaginal hæmorrhage has been controlled. The bladder is liable to be abnormally placed in these cases; and if its situation can be diagnosed before operation, the side opposite to that where its chief bulk lies should be selected for operation. It is of great assistance to have the os uteri fully dilated before operation. Indeed, a hard contracted os is a contra-indication if the patient's condition is so bad that time cannot be safely given to make dilatation.

It may be true that laparo-elytrotomy is easier than Cæsarean section; but on the face of it this does not seem to be the case. The making of the wound in the groin seems a formidable and somewhat difficult proceeding; and the division of the vaginal wall looks delicate, if not difficult; while the amount of laceration by the forthcoming child is uncertain, and may be hazardous. It is more than likely that the difficulties are apparent rather than real; it is certain that the appearance of difficulty has deterred many from operating by this method.

In Cæsarean section there is no real difficulty. Bleeding from the uterine wound may be momentarily alarming. Adroitness is necessary to prevent escape of uterine fluids into the peritoneum. Patience and delicacy are essential in closing the uterine wound. As compared with many abdominal operations, simple Cæsarean section is easy and straightforward. The Sânger-Cæsarean demands care and forethought, but can scarcely be described as difficult.

Porro's operation, as a piece of surgical work, is also easy. The difficulties are mainly in the management of the pedicle. A skilled surgeon may with perfect confidence dispense with temporary constriction, and will at the first attempt accurately place the wire of the *serre-nœud*. When this has been done, the other steps are simple enough. The case is not completed, however, till the constrictor has been removed, and accidents are to be apprehended while it remains attached.

From the operative standpoint, therefore, there is little to weigh in favour of any one proceeding.

Shock.—The condition of the patient at the time of operation is the main factor in influencing results. If the patient is exhausted by a prolonged and futile labour, an operation which of necessity is prolonged or is attended with great shock is forbidden. In respect of shock immediately produced, Porro's operation must come first; so far as time spent over the operation can influence the result, Thomas's operation, in which it may be necessary to dilate a rigid os uteri, is worst. In average cases, the facts that Thomas's operation may be finished in ten minutes, that it does not expose the peritoneum, wounds only cutaneous or unimportant structures, and that the child is extracted from the wound in the natural way, tell strongly in its favour. As productive of collapse, the Porro-Müller modification is most to be deprecated. Cæsarean section would seem to hold a middle position.

Hæmorrhage.—The danger from hæmorrhage, both immediate and remote, is greatest in Porro's operation. In a good many cases, wire or chain constrictors have been found inefficient in checking bleeding from the pedicle, and other extraordinary means have had to be adopted. In ordinary Cæsarean section, hæmorrhage has not infrequently proved fatal; one of the earliest hysterectomies had to be performed on account of bleeding. If the placenta is wounded, the danger is increased. If the uterus contracts well, bleeding is not likely to be dangerous; if it does not contract, it would probably be wise to finish by hysterectomy. In Thomas's operation, the risks of bleeding are small; the drawback is, if bleeding does occur, that it may be difficult to control. The vaginal rent may be indefinitely increased by the withdrawing of the fœtus, and bleeding may go on at the extreme end of the tear. But the torn vessels are not of large size, and simple means will compress them.

Peritonitis.—The large proportion of deaths from inflammations of the peritoneum, usually septic, following Cæsarean section was one of the strongest reasons adduced by Porro for the introduction of hysterectomy. But his operation has not done away

with this danger; in spite of all precautions, peritonitis kills 16 per cent. of all cases operated on by Porro's method. In laparo-elytrotomy peritonitis has only once appeared among the causes of death, and with proper care its occurrence ought to be rare.

Occurrence of future Pregnancies.—Too much has been made of the fact that in Porro's operation the possibility of future pregnancies has been done away with. In the face of other and simpler means, it is a ridiculous overdoing of surgery to amputate the whole uterus and ovaries to prevent the possibility of conception. In Cæsarean section, it is a very simple matter to carry out the suggestion that Blundell made many years ago, to cut out two little pieces of the Fallopian tubes: this would put the Cæsarean section, in that respect, on a level with Porro's operation. In Thomas's operation, the possibility of future pregnancies is in no way interfered with.

The final word has yet to be spoken as to the relative values of these operations. It may here be said that the results of Porro's operation have not been up to expectation, but show signs of improvement; that the improved Cæsarean section has been successful beyond expectation; and that Thomas's operation has made out for itself an extremely good position, warranting further trial. Beyond this, it may be permissible to go in the direction of pointing out special indications and contra-indications for each of the operations.

SPECIAL INDICATIONS AND CONTRA-INDICATIONS.

Laparo-elytrotomy.—Garrigues has mentioned, as contra-indications to this operation—

- (1) The impossibility of repeating the operation on the same side.
- (2) Impaction of the head in the pelvis.
- (3) The presence of a large tumour in the vagina.
- (4) An obstruction in the womb itself (as malignant disease of the cervix).
- (5) Atresia or considerable narrowing of the vagina.

Stadfelt of Copenhagen has added another objection to the operation; namely, a tumour arising from the anterior wall of the pelvis, and pushing the vagina backwards.

It would be considered an unfavourable condition if the thighs were bent and ankylosed, or so distorted that they obstruct the site of operation in the groin. Cicatrices in the groin or pelvis, indicating old or deep-seated suppuration, are unfavourable, but not strongly so.

The indications may be considered favourable if, with an absence of the above conditions, there is present a fully dilated or readily dilatable os uteri; if the vagina is capacious and free from heat or congestion, and has not been bruised or injured by previous manipulations; and if the patient is in a fair condition of general health. Profound exhaustion from the labour is against Porro's operation, and, according to most writers, would tell less against laparo-elytrotomy than against the Cæsarean section.

Porro's Operation.—Hysterectomy is indicated in cases of uterine fibroid complicating labour. It is further specially indicated in cases where the Cæsarean cannot be completed: such are, free bleeding from the uterine wound; inertia of the uterus, with bleeding from the site of the placenta; difficulty in detaching the placenta; tendency to inversion of the uterus. In great and incurable atresia vaginæ, Porro's operation is to be advised, because the uterine discharges after Cæsarean section have not free exit. Putridity of the uterine contents is an indication for Porro's operation.

It is contra-indicated in cases of great exhaustion, where the shock of hysterectomy would endanger the patient's life. In cancer of the uterus, Porro's operation ought, if possible, to be converted into complete hysterectomy; otherwise, Cæsarean section is perhaps preferable.

Cæsarean Section.—In all cases of tumour occupying the body of the uterus, Cæsarean section is inadvisable. Otherwise, there is scarcely a condition in which operative delivery may be

called for where this operation is not feasible. It has the widest primary applicability of the three. But during the progress of the operation certain conditions—as, uterine inertia, hæmorrhage, abnormal adhesion of the placenta—may be met with which render it advisable to complete the operation by Porro's method. Other conditions discovered during operation—such, for instance, as disease of the uterine appendages—may suggest completion of the proceeding by hysterectomy. A wound in the uterus which does not promise to be easily or satisfactorily sutured is a contra-indication to the simple Cæsarean conclusion.

It is, in fact, one great advantage of operating by median abdominal section, that the surgeon can finish by the improved Cæsarean method or by Porro's, as seems at the time most suitable.

Coeliotomy for Rupture of the Uterus. Puerperal Coeliotomy.

Anatomical Conditions.

Rupture or Bursting.

Laceration.

Grinding or Crushing.

Avulsion.

Symptoms and Diagnosis.

Mortality and Appreciation.

Operation Described.

ANATOMICAL CONDITIONS.

Rupture of the pregnant uterus may take place at any period of gestation from the third month onwards. It may arise spontaneously, or at least without apparent cause; also after violent strains or falls, or exhausting occupation; but in most cases rupture takes place at full term, and on the advent of labour. Here we need not discuss the somewhat unsettled question as to its exact etiology.

Barnes* gives the following classification of the varieties of rupture:

"1. *Rupture or bursting* occurs when, under strong tension of the uterus upon its unyielding contents, its walls burst more or less suddenly in the body or cervix.

"2. *Laceration or rent* occurs when a breach begins at the edge of the os uteri, and extends.

"3. *Grinding or crushing* occurs when the uterus is subjected to long compression between the child's head and the pelvic wall.

"4. *Perforation or boring through* occurs when tissues give way from disease or long compression at one point, or from penetration by a spike of bone or by instruments.

* *Obstet. Med. and Surg.*, 1885, vol. ii., p. 312.

"5. *Avulsion*.—The uterus has been torn away by manual force."

In *rupture or bursting* at full term, either during labour or before labour has properly set in, we usually find that the whole ovum, membranes and all, is thrown bodily into the abdominal cavity. The os may be undilated. The rent rarely takes place through the body or fundus, but almost always near the cervix or in the lower segment.

Laceration in the great majority of cases is associated with some obstruction to labour. The liquor amnii has usually escaped, and the uterus is closely contracted on the child. The uterine tissue may be torn away from its attachment to the cervix, and the laceration is then transverse. Complete annular divulsion of the cervix may, under these circumstances, be observed. Another mode of laceration is produced when the cervix will not dilate over the descending head, and is torn through longitudinally, the rent extending upwards into the uterine tissues.

Grinding or crushing is found at that part of the uterus which lies in contact with the bony prominences, and is specially prone to occur when these prominences are unduly marked. Openings made in this way have jagged edges, are much bruised, and perhaps broken into shreds: their direction is transverse to the uterine axis. *Perforation* or boring through at a point of the uterus weakened by disease, or thinned and bruised by compression, is practically the same as crushing.

Complete detachment of the uterus may take place by annular lacerations through the cervix, or the vagina; and the organ may be bodily torn away from its attachments, after delivery by manual force.

SYMPTOMS AND DIAGNOSIS OF RUPTURE OF THE UTERUS.

Surgical treatment is rarely called for until there are symptoms that the foetus has been extruded through the rent into the abdominal cavity. But in many cases it is possible to diagnose the condition with a fair degree of certainty before this

catastrophe has taken place, and more particularly when the fœtus has only partially escaped.

The following description of the symptoms of rupture is from Barnes's pen : * " Sudden acute pain, with a sense of rending in the belly, sometimes attended with an audible snap, it is said ; quick collapse, marked by pallor, fainting, extinction of pulse ; vomiting ; some hæmorrhage externally, and the signs of anæmia from greater loss internally ; cessation of uterine contraction. If the child be thrust wholly or partly out of the womb, the abdomen flattens somewhat ; there is retreat of the presenting part of the child from the os uteri ; occasionally, prolapse of the intestine in the vagina, or beyond the vulva ; great pain, especially on palpation of the abdomen, where irregular hard projections are felt, which may be identified as parts of the fœtus. If the effusion of blood be great, there is increased and distressing tension of the abdominal walls. Cramp-like or spasmodic pains follow. The flushed face becomes suddenly deadly pale ; the eyes lose their brilliancy ; the whole surface is covered with a clammy sweat ; trembling of the limbs or repeated faintings announce a profuse internal hæmorrhage. Presently, when reaction comes, the patient complains of feeling a warm fluid pouring out in the neighbourhood of the groins and loins. She sometimes feels the movements of the child when it has escaped into the abdomen. But usually the child dies quickly.

" It has, however, often been observed that the symptoms are not so strongly marked. Sometimes very little is complained of at the time when it was presumed that the injury took place. The collapse creeps on gradually. The woman may be even capable of walking about for some time. * *

" But, sooner or later, almost always within two or three hours, collapse becomes pronounced and pain is severe." In such a case we may infer that the process of tearing has been gradual.

In many cases the acute symptoms are preceded by signs of obstruction to delivery. Boring through of the uterine tissue

* *Op. cit.*, p. 342.

may be going on, while the patient's symptoms are simply those of exhaustion or irritation under long-continued labour. The completion of the tearing is shown by the onset of the violent symptoms just described.

When the foetus has been extruded into the abdominal cavity, the diagnosis is completed by passing the hand into the uterine cavity, and detecting the rent. Intestine may be felt passing into the uterine cavity, or even into the vagina.

MORTALITY AND APPRECIATION.

The statistics of the mortality after rupture of the uterus have been fully studied and reported by Merz.* He has collected 230 cases, 94 untreated and the rest treated in various ways, 54 being by coeliotomy. Of the untreated cases 70 had complete rupture, 10 recovered; 21 had incomplete rupture, 4 recovered; 3 doubtful cases all died. The modes of treatment employed were varied. Compression of the abdomen by bandage was employed in 5 cases, with 3 recoveries. Intra-uterine tampons were inserted in 25 cases; 9 of these recovered. Tube drainage in 19 cases gave 12 recoveries. Drainage by an iodised skein of thread in 8 cases gave 7 recoveries. Drainage, washing out and irrigation was the treatment in 7 cases; 5 recovered. Coeliotomy with suture of the rent in 24 cases gave 10 recoveries; without suture in 15 cases gave 8 recoveries; with amputation of the uterus in 15 cases gave 8 recoveries. Merz in addition gives separate statistics for cases of incomplete and of complete rupture, but the difference in the mortality is much less than might be expected; in fact the death-rates are nearly equal.

It is clear that treatment of some sort greatly lowers the mortality: without treatment, only one case out of five or six survives; with treatment, nearly half the cases are saved. The per-centage of recoveries is variously placed at 68 (Jolly), 86 (Trask), and in the United States at 53 (Harris). Merz gives a death-rate of a little over 50 per cent.

The best results have been got after drainage by a skein of

* *Arch. f. Gynäk.* xlv. 2, 1893.

iodised thread, no fewer than six out of seven cases of complete rupture so treated having recovered. This would be possible only where delivery of the child by the natural passage was possible; that is to say, only in a moderate proportion of cases.

The mortality is certainly not so high as might be expected, considering the terrible nature of the accident; perhaps it is not so high as it ought to be. The worst cases are permitted to die; if more cases were operated upon more lives would be saved, but the whole death-rate after operation would be raised.

OPERATIVE TREATMENT OF RUPTURE OF THE UTERUS.

The nature of the treatment will depend on the actual conditions found in respect of the completeness or incompleteness of the rupture; the position of the child, whether wholly or partially intra-peritoneal or intra-uterine; and the condition of the patient. The last circumstance, the ability of the patient to bear a severe operation, must have great weight. The operation of election in a case of complete rupture would always be suture of the rupture after coeliotomy. But a combination of circumstances, such as a wound with ragged and bruised edges situated low, a flaccid uterus and an unfavourable general condition of the patient, would make uterine amputation preferable. On the other hand, if we meet with the combination of a moderately clean straight wound favourably placed for suture, a contracting uterus and a not desperate condition of patient, we may resort to hysterorrhaphy. In all such cases some form of intra-uterine drainage would be adopted.

The position of the fœtus, to a considerable extent, determines the nature of the operation. If the head is in the pelvis and the body in the peritoneal cavity, delivery through the vagina may be made with forceps, and then there is a possibility of leaving the healing to nature after providing for intra-uterine drainage by gauze. If the patient is very ill this possibility will probably be gladly accepted.

If the head is in the cavity and the body is in the uterus, Merz recommends that coeliotomy be performed and delivery

be made through the parietal incision. If the whole fœtus is in the cavity, coeliotomy must be done. Where the child has been delivered naturally, coeliotomy and suture of the tear is still the indication; but circumstances may render tamponnage and drainage preferable, or even hysterectomy.

When coeliotomy is decided on, the operation is begun exactly as for Cæsarean section. The child and placenta are extracted; blood-clots are removed, and the abdomen is thoroughly cleansed by irrigation and sponging. To discover the rent it may be necessary to turn the uterus out of the wound. The method of suturing recommended for ordinary Cæsarean section is the best. If the edges of the rent are much bruised or lacerated, then hysterectomy is recommended. Drainage by the vagina, if the opening is on the posterior surface, may be used with advantage.

Puerperal hysterectomy for rupture of the uterus differs in no important particulars from the operation as performed for other reasons. The incision is made in the ordinary way. If the ovum is intact, an attempt may be made to remove it bodily; but this cannot often succeed. Much time may be saved by removing as much of the amniotic fluid as possible by tapping before removing the ovum from the cavity. In every case the whole ovum—membranes, fœtus, and placenta—will be removed bodily, and as far as possible intact. No particle of tissue is to be left behind.

If the fœtus alone is extruded, and the placenta and membranes remain inside the uterus, the fœtus is removed, and the cord divided and compressed or tied. Then the collapsed uterus is turned out through the wound, to be clamped and removed. If the fœtus is only partially extruded, it is quickly pulled through the rent; and as soon as it is removed, a temporary constrictor or the hand is passed round the uterus, as low down as possible, to prevent hæmorrhage.

The uterus being turned out on the abdomen, and the situation of the rupture having been ascertained, several large sponges are packed into the abdominal cavity. Before putting on the clamp, the finger should be passed to the inside of the uterus, to make sure that the whole of the torn tissue, inside as well as outside, is above the level fixed for applying the wire.

The pedicle is then clamped, fixed in the wound, and treated exactly as in Porro's operation.

Attention is now paid to cleansing of the abdomen, which must be as thorough as possible consistently with rapidity. The large sponges, soaked with blood and amniotic fluid, are removed. The cavity is thoroughly washed out with aseptic fluid, at 99° Fahrenheit, by means of an irrigator with a large tube, while the intestines are freely moved about by the fingers inside the cavity. When the fluid returns clear, fresh sponges are placed in the pelvis and in the hollows of the loins, to soak up what remains. Too much time must not be wasted in endeavouring to get the cavity perfectly dry.

Drainage will be called for in a proportion of cases greater than in ordinary Porro's operations, because of the extravasation before operation. Indeed, the insertion of a drainage tube after this operation can scarcely ever be other than good practice.

The further procedures as regards closure of wound, management of pedicle, and treatment of patient are in no way different from those described under Porro's operation.

Symphysiotomy.

History.

Mortality and Appreciation.

Indications for Operation.

Operation Described.

Instruments.

Position and Preparation of Patient.

Incision.

Division of Symphysis.

Separation of Symphysis.

Delivery of Child.

Closure of Wounds.

After-Treatment.

Complications.

By this operation is meant division of the symphysis pubis, so as, by separation of the wings of the pelvis, to increase the diameter of a contracted conjugate, and thus permit delivery of a living child.

History.—The operation was first suggested by Sigault in 1768, and was performed by him and Leroy first in 1777. It never came into favour, and was actively opposed by Baudelocque and other distinguished authorities. Its results were evidently very bad.

It had apparently been cast into the limbo of rejected operations when, in 1891, Prof. Morisani of Naples resuscitated it, and had successful cases. Prof. Pinard of the Baudelocque hospital in Paris permitted an experimental operation in his clinique and was favourably impressed, as were Tarnier and Faraboeuf. At the obstetrical clinic at Naples 24 operations gave 24 maternal recoveries, with 23 living children. Pinard* had a first record of 19 consecutively successful operations as regards both mothers and children, 3 of the children dying after a few days, however. Such reports made a strong impression on obstetricians, and the

* *Rev. de Chir.*, Feb., 1893.

operation was evidently re-installed amongst the measures available for terminating difficult labour.

Mortality and Appreciation.—Statistics of Symphysiotomy have been provided by Varnier,* Morisani,† and Harris‡. Varnier collates 124 operations, with 12 maternal deaths and 32 children's deaths. Of the maternal deaths 8 were said to be unconnected with the operation; septicæmia, cellulitis, and peritonitis from use of the saw; sphacelus of vulva and vagina; and hæmorrhage and shock account respectively for the four operative deaths. Morisani gives 241 cases, with a mortality to mothers of 11.6 per cent., and to children of 19.9 per cent. Harris puts down the mortality between 1887 and 1893 as between 10.7 and 12.3 per cent.

The mortality, therefore, is high; it is certainly over 10 per cent. The operation certainly has not suffered at the hands of unskilled or inexperienced operators; on the contrary, it has had the benefit of an introduction by experienced men of the highest skill. There are, as will be seen, uncertainties as to the extent and the nature of the injuries which the operation introduces, which have not yet been overcome, but which, if removed, may place the operation on a more favourable footing.

The operation is on all hands admitted to be difficult. One operator (Hirst), after experience of both, prefers Cæsarean section as being easier.

Indications for Operation.—The operation is not in competition with Cæsarean section or allied operations. It is generally agreed that the conjugate diameter for symphysiotomy should not be below three inches, and that below this measurement Cæsarean section is preferable. Morisani would limit it to cases of impossible delivery at term, and would operate only when labour is well advanced and where the os uteri is fully dilated. The woman also should be in favourable general condition; she should

**Ann. de Gynéc et Obstet.*, 1893, xxxiv., p. 241.

†*Internat. Congress*, Rome, 1894.

‡*Amer. Journ. Obstet.*, 1894, xxx., p. 758.

not have been exhausted from prolonged labour. The child should be ascertained to be living; otherwise embryotomy is perhaps preferable.

To estimate the amount of increase of the conjugate diameters which given degrees of separation of the pubes will provide, we have the tables of Faraboeuf* and the *post-mortem* experiments of Mr. Roberts.† Their results, broadly speaking, coincide that it takes a separation of three inches at the pubes to get an inch of increase in the conjugate. As it has not been found safe to carry separation more than two or, at most, two and a-half inches, we can scarcely count on a certain conjugate increase of more than three-quarters of an inch. In certain forms of narrowing the proportionate conjugate increase may be greater than that named; but this cannot be reckoned upon beforehand.



FIG. 97.
Galbiati's Knife
for dividing the
Symphysis.

THE OPERATION.

Instruments.—The operation may be done with ordinary scalpel and catch forceps, without any special instruments. Galbiati's knife (Fig. 97) for dividing the symphysis may be of advantage. In case the symphysis is ossified, a saw should be in readiness. A fine Adams's saw, or an ordinary chain saw or a wire-thread saw, introduced from behind the pubes and cutting forward, may be employed. It is always advisable, however, on account of the *débris* it leaves, to avoid the use of the saw. Special instruments for measuring and regulating the amount of separation are in use (Fig. 98); few surgeons seem to care about using them.

To deal with hæmorrhage, which may be free and difficult to control, acupressure pins and the actual cautery should be in

* *Ann. de Gynéc. et Obstet.*, 1892, xxxviii., p. 404.

† *St. Bart. Hosp. Rep.*, 1894, xxx., p. 27.

readiness. Special needles, with holder, for suture of any possible tear of urethra or bladder should also be provided. Sounds and catheters for the bladder may be required. In addition to these, the ordinary midwifery forceps and other instruments likely to be useful in delivery should be at hand.

Position and Preparation of Patient.—The patient is placed in the lithotomy position, the surgeon standing between the thighs. An assistant takes charge of each limb, which he will manipulate as the surgeon directs him. The pubic and vulvar hair is shaved and the parts all round are thoroughly disinfected; the vagina also is cleansed. The bladder is emptied by catheter; the instrument may be left *in situ* as a guide to the position of the urethra during the cutting parts of the operation.

The Incision is made in the middle line over the symphysis through the mons veneris, beginning just above the clitoris and extending for about an inch above the level of the pubes. The space between the recti is divided, and the prevesical space (cavum Retzii) is entered. To provide space for manipulation, it may be advisable to divide the insertions of the recti close to the pubes for a little way on each side of the middle line. The forefinger is now carried into the prevesical space, and pushes the vascular fat backwards away from the symphysis. When the symphysis is completely denuded of all loose tissue in front and behind, it is ready for division.

Division of Symphysis.—While this is being done, Harris recommends that the thighs be kept together, as after the parts are divided the bones may suddenly spring apart and cause a severe laceration of the underlying tissue. While division is



FIG. 98.

Pinard's Registering
Dilator for
Symphysiotomy.

being made, the forefinger of the left hand is kept behind the symphysis to prevent any accidental injury to underlying parts. Division is made from before backwards by an ordinary scalpel or by a special knife (Fig. 97). The fibres are divided by separate cuts, the scalpel avoiding bone and following the irregularities of the surface out and in, so as to incise fibres only. The finger will tell when division of the symphysis is complete; it is usually signified by a little spontaneous separation of the bones. They are still kept together by the powerful ligamentum arcuatum or sub-pubic ligament, which forms the upper boundary of the pubic arch and runs downward on the rami of the pubes.

The rule hitherto has been to divide or to tear through this ligament. Harris makes out a strong case for separating it from the pubic margins. The ordinary method of division, he points out, exposes the strong deep layer of the perineal fascia to injury; and such injury, considering the important and vascular tissues, greatly enlarged during pregnancy, which are in relation with and supported by the fascia, may be serious. The urethra which passes through it, and the vascular plexus at the neck of the bladder, run most risk. The tearing of these parts and the free bleeding that results are certainly the chief risks of the operation. Each act of divulsion may cause more tearing and more bleeding, which cannot be by ordinary means controlled; and may, indeed, require restoration of closure and packing with pressure. Acupressure has been used and the actual cautery. There is no doubt that any means which will remove or diminish this risk of indefinite laceration of the vascular tissues behind the pubes will be gladly welcomed.

The means Harris suggests and has successfully used are, to separate the sub-pubic ligament downward on each side along the rami of the pubes, with it carrying the deep perineal fascia and the parts related and attached to it. A blunt-pointed bistoury, guided by the forefinger inside, is made to pass, closely hugging the bone, downwards on each side for a sufficient distance. "As fast as the tense fibres are divided from the arch, it will be seen that the space at the symphysis gradually widens. When the fibres of the deep fascia are no longer felt tense, it will be

found that the symphysis has separated as widely as it can without straining the sacro-iliac joints. The separation will usually amount to from five to seven centimetres. This I consider the most important step of the operation ; and if the ligament and fascia be carefully detached laterally from the bone, all danger of hæmorrhage and laceration of parts will be effectually avoided."

Separation of the Symphysis, if the operation has been done as Harris recommends, will have taken place spontaneously. Most operators use careful abduction of the thighs to cause the necessary amount of separation. During this proceeding, if the sub-pubic ligament is not separated, tearing of the soft parts goes on with more or less bleeding. Pinard uses a registering separator. Separation should be carried to the extent of at least four centimetres ; it should not exceed six.

Delivery of Child.—Forceps are now applied and the child delivered. How much, if any, further separation the descending head of the child will cause is uncertain. The assistants, meanwhile, should watch and try to control the amount of separation, and perhaps increase of laceration, that may result. The placenta is at once removed.

Closure of Wounds.—Pinard uses four deep and four superficial silver sutures for uniting the bone. Others use no sutures to the bone at all. It seems certain that satisfactory union takes place without sutures at all. The parts are maintained in apposition by keeping the thighs close and by placing the patient on concave cushions which embrace the hips. Periosteal silk sutures can do no harm and may help to keep up accurate apposition. A broad strip of plaster carried round the pelvis is recommended by Harris, and would serve the purpose well. A special belt has been devised and used.

The cutaneous wound is sutured, drained, and dressed in the ordinary way. A drainage tube should be placed in the prevesical space.

After-treatment. Complications.—The progress of a case doing well requires no description. Recumbency should be maintained for at least a month. Thus far any impairment of movement as a result of division of the symphysis seems to be conspicuous by its absence.

The chief danger to be apprehended after operation is septic inflammation with cellulitis spreading around the seat of operation. There may be considerable sero-sanguineous oozing from tearing of the parts. Laceration of the bladder or the urethra is treated by placing a catheter in the bladder and providing efficient drainage to prevent urinary infiltration. If urinary fistula remains, a subsequent operation may be necessary.

Operations for Ectopic Gestation.

History.

Pathological Anatomy.

Changes in the Tube.

Changes in the Ovum.

Rupture of the Sac-Primary.

Intra-peritoneal.

Extra-peritoneal.

Tubal Abortion.

Secondary Rupture of Sac.

Intra-peritoneal.

Extra-peritoneal.

Tubo-uterine Gestation.

Later Developments.

Scheme of Classification.

Indications to Operate.

Operations Described.

Minor Proceedings.

Removal of the Sac in early Months.

Operation for Hæmorrhage from Rupture of Tube.

Operation between Fourth Month and Term.

Operation with Child alive.

Operation for Rupture during Spurious Labour.

Operation with Dead or Decomposing Fætus.

Under this head are discussed the operative proceedings which may be employed for extra-uterine pregnancy properly so called, and for those cases of misplaced uterine pregnancy in which spontaneous delivery cannot take place. The latter condition has its type in cases of pregnancy in one horn of a uterus bicornis, and is often, from its most marked clinical feature, spoken of as "missed labour." This name is, however, occasionally applicable to all forms of ectopic gestation.

History.—Heister,* in naming the indications for abdominal section, places first this one—"when the fœtus is contained in the Fallopian tube, the ovary, or the cavity of the abdomen." Simon,† in his elaborate review of the Cæsarean operation, speaks of abdominal gestation as an indication for operation. In reviewing the history of actual operations, it is difficult to decide as to their real nature. The earliest operations were probably performed after a suppurating sac had shown signs of bursting, and were little more than the opening of an abscess. Christopher Bain's case, in 1540, was little more than the opening of an abscess. The well-known cases of Noierus in 1591, and of Cyprian in 1694, were almost certainly of this nature. The first genuine coeliotomy for extra-uterine fœtation was probably that of Primerose in 1594, who successfully operated on Noierus's patient when she again became pregnant. Several other successes were about this time reported from the Continent. In 1764 Mr. John Bard, a New York surgeon, first operated in America; he was followed by Baynham, McKnight, Wishart, Stevens, and others (nearly all country practitioners), and a considerable number of successes were registered. These operations extend to about 1850, the beginning of the era of ovariectomy. Up to the end of 1875, Dr. Parry, for his classical work on *Extra-uterine Pregnancy*, had collected a list of 62 operations for the removal of extra-uterine children, with the encouraging result of 30 successes and 32 failures.

But as anatomical and clinical knowledge extended, so did the sphere of operation. For rupture of the sac in the early stages, little or nothing was done till recent times. In 1849 Dr. Harbert, an American surgeon, first suggested operative treatment for this terrible accident; but little attention was paid to his proposal till 1866 and 1867, when Dr. Stephen Rogers of New York wrote and urged operation.‡ Moreau,§ curiously enough, while strongly urging abdominal section for rupture of the sac during spurious labour, condemns it for rupture in the

* *Op. cit.*, vol. ii., p. 28. † *Mem. de l'Acad. de Chirurg.*, Paris, vol. ii., 1753, p. 308.

‡ *New York Med. Rec.*, 1867, vol. ii., p. 22.

§ *Traité Pratique des Accouchements*, ii., 367; Paris. 1841.

early stages. The operation made no headway till Tait, in recent years, took it up, and, by a remarkable series of successes, placed it in the front of major life-saving operations. Up to Oct. 26th, 1887, Tait* had operated for early ruptured pregnancy 35 times, with 2 deaths.

PATHOLOGICAL ANATOMY.

The actual origin of extra-uterine foetation ought to include a consideration of its causation. Of this little is known. Suffice it to say that it specially occurs in women who have shown an "inaptitude for conception," who have for abnormally long periods been sterile; and in women who have some malformation of the uterus, congenital or acquired. More definitely, catarrh of the Fallopian tube has been laid down as a cause. When the ciliated epithelium is shed in any part of the tube, the ovum cannot be passed along it; it rests in the denuded space. Here the spermatozoa, endowed with independent powers of motion, reach it and impregnate it; and here it develops. Obstructive catarrh of the Fallopian tube, blocking the canal sufficiently to prevent passage of the large ovum, but not enough to prevent the passage of the small spermatozoa; adhesions on the outside; simple derangement of the physiological functions of the tube—spasm, or paralysis, or irregular action—have all been assigned as causes.

The elaborate classification of the varieties of misplaced conception, as given by the earlier writers (Dezemeris gives ten varieties), has now been reduced to one or two. Parry limits the species to three—Tubal, Ovarian, and Abdominal: these he subdivides into eight varieties. The simple theory of Tait, held by Gaillard Thomas and other prominent gynæcologists, explains all varieties. He holds that all extra-uterine conceptions are at first tubal, and that all further varieties are produced after rupture of the primary tubal sac and escape of the ovum. Interstitial pregnancy is simply a variety of tubal, where the tube enters the uterus; ovarian pregnancy is tubal among

* *Brit. Med. Journ.*, 1887, vol. ii., p. 1050.

the fimbriæ. If the rupture takes place on the under surface of the tube where it is embraced by the broad ligaments, the ovum may develop in the enclosed cellular tissue, and be extra-peritoneal. If the rupture takes place on the free surface of the tube, the ovum escapes into the abdominal cavity, and may develop there.

The dismissal of ovarian pregnancy cannot, however, be made in a word. It is just conceivable that the ovum may not escape from a ruptured follicle, and that spermatozoa may enter the follicle and fertilise it. Putting aside the older cases, we cannot utterly ignore the accurately recorded cases of Kammerer* and Porter.† Lusk, Spiegelberg, Werth, and other competent modern authorities admit the validity of the evidence in favour of the possibility of this variety. Reeves‡ records a case of successful operation for what he believes to have been true ovarian pregnancy; the evidence, however, as put forth in the narrative does not seem to be conclusive. Most cases of so-called ovarian pregnancy are undoubtedly instances where the sac has developed among the fimbriæ of the tube, and become intimately adherent to the ovary; and it is just possible that all are to be so explained.

Interstitial pregnancy is simply development of the ovum in that part of the tube which passes into the uterine cornu; and not in the uterine tissue, as Breschet, Meyer, and others, supposed.

The possibility of primary abdominal pregnancy cannot be denied, in the face of such evidence as is afforded by cases of impregnation through abnormal orifices in the uterus. Two such are recorded by Lecluyse§ and by Koeberlé—one through an opening unclosed after Cæsarean section, the other through the canal left after hysterectomy for myoma. Some doubt has recently been thrown on the reality of Koeberlé's case. A case of Keller's|| is noted by Spiegelberg, in which abdominal pregnancy occurred two years after an almost complete hysterectomy.

* *New York Med. Journ.*, 1865, p. 141.

† *Amer. Journ. of Med. Sc.*, Jan., 1853. ‡ *Lancet*, 1890, vol. ii., p. 872.

§ *Bull. de l'Acad. de Méd. Belgique*, 1869.

|| Related by Keller, *Des Grossesses Extra-utérines*, Paris, 1872.

As a pathological curiosity, we may note the occurrence of pregnancy in tubo-ovarian cysts. Paltauf* has minutely described such a case; and refers to two other similar cases, though with some doubt as to their reality.

Practically, we may admit the general, if not the absolute, truth of the following propositions:

(1) Every extra-uterine pregnancy is at first tubal. Occurring where the tube is close to or passing through the uterine tissue, it may be called Interstitial; where it is broken up into fimbriæ at the infundibulum, it has been called Tubo-ovarian; elsewhere in the tube, it is simply named Fallopian.

(2) When rupture of the sac takes place, the ovum may escape into the abdominal cavity or into the cellular tissue between the layers of the broad ligament. The former is known as intra-peritoneal, and is at once the most common and the most dangerous; the latter is less dangerous, naturally, and more easily dealt with practically.

The changes which follow the arrest of an impregnated ovum in the tube have been minutely studied and clearly described by Bland Sutton† and by Webster.‡ Here it is impossible to do more than to indicate the outlines of the pathological processes and sequences observed, and these only in so far as they have a direct bearing on surgical treatment.

Changes in the Tube.—The tube increases in size, not, as in the uterus, from increase in the size and number of the muscle cells, but from increased turgescence and vascularity. As the tube dilates the glandular folds are effaced around the ovum, though a few may remain. A curious result is closure of the abdominal ostium, an event which is usually completed about the end of the eighth week. This is caused by a sort of plastic inflammation of the peritoneum covering the fimbria, whereby complete occlusion is secured. Bland Sutton quotes some observations which lead him to conclude that this process of occlusion may be arrested by rupture of the tube.

* *Arch. f. Gynäk.*, 1887, xxx., iii.; *Lond. Med. Rec.*, 1887, xv., p. 300.

† *Surg. Dis. of Ovaries*, 1891, p. 311 *et seq.* ‡ *Ectopic Pregnancy*, 1895, p. 113.

Changes connected with the Ovum.—Cellular dendritic processes, chorionic villi as they are called, develop on the surface of the ovum and join it to the tubal mucous membrane; these soon become vascularised, most of them atrophy, some increase in size and complexity and form the foetal portion of the placenta. Till the placenta is formed the union of ovum and tube-wall is not firm, and is easily displaced by hæmorrhage or traumatism. The ovum thus dislodged is analogous to abortion in the uterus, and the body is known as a "blighted ovum" or a "fleshy" or "carneous mole." Such detachment is most common between the fourth and eighth weeks, and may be associated with free hæmorrhage. A tubal mole is usually oval, about the size of a walnut; is in appearance like a blood coagulum, and usually has a central cavity lined with smooth amniotic membrane, and occasionally containing an embryo. The presence of chorionic villi in the clot proves its true character.

Rupture of the Gestation Sac.—The natural tendency of a pregnant Fallopian tube is to rupture. Those cases which escape rupture either have tubal abortion, with or without discharge of the ovum into the abdomen through the ostium; or they go on towards term with the pregnancy persisting—a rare result.

Rupture is spoken of as "*Primary*" and "*Secondary*": Primary being when it occurs between the third and tenth or at latest the twelfth week; Secondary referring to rupture at any period between the twelfth week and term. A further division of each variety is into intra- and extra-peritoneal.

In the case of Primary rupture, "extra-peritoneal" refers to the areolar tissue between the layers of the meso-salpinx and broad ligament; two-thirds of the circumference of the tube is invested by this structure. When an embryo develops inside the tube the layers of the meso-salpinx become separated. Rupture of the tube into the areolar tissue between these layers is known as "extra-peritoneal"—the blood effused escapes into the areolar tissue between the layers of the meso-salpinx and thence of the broad ligament. Rupture in any other part of the circumference of the tube is "intra-peritoneal"—the blood escapes into the

abdominal cavity. In the outer third of the tube separation of the layers of the meso-salpinx does not take place, and here rupture is usually intra-peritoneal.

"In *primary intra-peritoneal rupture*, the ovum, accompanied by a variable amount of blood, may be discharged directly into the abdominal cavity. The quantity of blood extravasated depends upon the date of rupture. When it occurs early, the blood extravasated may amount to a few ounces; but after the first month it is usually very copious, and frequently causes death in a few hours. When rupture is deferred until the seventh week the ovum is not so constantly discharged through the rent, and as the walls of the gestation sac are prevented from contracting, the amount of blood which escapes is often very large." (Bland Sutton.)

The usual result of primary intra-peritoneal rupture is, unless operation is performed, death. Such death may be caused by the first hæmorrhage or after repeated hæmorrhages. When the hæmorrhage is not excessive and the patient survives the immediate dangers, the blood collects in the recto-vaginal pouch and floats up the intestines, which with the omentum form a sort of false capsule to the clot. Such a clot may slowly be absorbed. Rarely peritonitis results.

"*Primary Extra-peritoneal Rupture*.—In a fair proportion of cases the tube ruptures through that portion of its circumference lying between the separated layers of the meso-salpinx. When this happens the blood and ovum are forced into the connective tissue between the layers of the broad ligament. In most cases this is fortunate for the patient, as the bleeding becomes checked by the pressure exerted by the resistance which occurs when the mesometric tissue becomes distended, and is arrested before it assumes dangerous proportions. In such cases it is fortunate for the patient if the ovum has been converted into a mole, for then the pregnancy is ended; the blood and ovum are sepulchred, as it were, in the mesometrium, and rarely cause subsequent trouble.

"Rupture may take place, and the embryo remain uninjured and continue its development with advantage, for, no longer confined within the narrow limits of the tube, it begins to avail

itself of the additional space thus offered, and burrows as it grows between the layers of the mesometrium.

The process of extrusion after rupture is probably a slow and gradual one; the growing embryo leaving behind it the small sac, and forcing its way by slow degrees into the areolar space. This is known as a 'broad-ligament gestation.'

Tubal Abortion is the term "applicable to cases in which hæmorrhage takes place from a gravid tube, the blood entering the peritoneum through an unclosed ostium, the tube remaining whole. . . . The ovum is discharged with a copious hæmorrhage into the peritoneal cavity through the ostium, accompanied with the usual signs of internal bleeding, and death may occur early from the anæmia thus induced or from shock." (Sutton.)

In such instances, the ovum being very small escapes recognition when the clot is examined. Tubal abortion can occur only during the first two months, that is before closure of the ostium. The ovum is not always discharged at once; in some cases it is retained many days by some portion of the chorion.

"*Secondary Rupture*.—When the pregnancy continues between the layers of the broad ligament, the gestation sac may at any moment rupture, and the risk of this accident is much greater when the placenta is situated above the fœtus. As the pregnancy progresses, the peritoneum forming the sac becomes stretched and stripped from adjacent parts and from the viscera. Sometimes as the sac extends into the abdomen it will strip the peritoneum from the anterior abdominal wall, as in the case of an over-distended bladder, only to a much greater extent When the serous membrane is stripped from the posterior aspect of the pelvis, the rectum may be deprived of its serous investment, as well as the posterior surface of the uterus, the fœtus and placenta insinuating themselves between these parts beneath the peritoneum.

"At any period between the twelfth week and term the gradually-thinning gestation sac may rupture. The effects of this accident vary. When the rent involves the placenta, as is almost certain when this organ is situated above the fœtus, terrible hæmorrhage and a speedy death are the usual consequence if the

gestation has advanced beyond the mid-period of pregnancy; before this date the hæmorrhage may not always be so severe, and will afford opportunities for surgical intervention. When the sac bursts into the peritoneum in this way, it is spoken of as *secondary intra-peritoneal rupture*.

"When the placenta occupies the pelvis, and the foetus the abdominal portion of the sac, the latter may become so slowly thinned that at last it yields and the foetus is set free into the peritoneal cavity and disports itself among the intestines.

"It must be remembered that secondary rupture may be indefinitely delayed, and in some cases never occurs. The patient goes to term, passes through a *spurious* labour, the liquor amnii is absorbed, the placenta disappears, and the existence of an extra-uterine pregnancy never suspected until a mummified foetus or a lithopædion is discovered at the autopsy.

"*Secondary extra-peritoneal Rupture* occurs after the death of the child, and is, in nearly every case, induced by suppuration of the sac. 'The condition is analogous to that found after rupture of any abscess into the peritoneal cavity, and is attended with similar dire results.'" (Bland Sutton, *op. cit.*, p. 343.)

Many other interesting features in connection with extra-uterine gestation have been elucidated and discussed: such are, the rare conditions of combined intra- or extra-uterine gestation; concurrent gestation in each tube (twin-tubal gestation); uterine gestation occurring subsequently to tubal. As the treatment of these conditions demands no novel methods, but rather a combination of old and recognised ones, and as their full consideration would pass beyond the limits set to this work, nothing further will be said about them.

Tubo-uterine or Interstitial Gestation is where the fertilised ovum develops in that portion of the tube which passes through the uterine wall. It must not be confused with true cornual pregnancy, as is often done. It is very rare. Here, instead of thinning of the sac such as occurs in the true tubal variety, there is thickening which extends into and involves the uterus proper. "This hypertrophic condition of the walls of the sac explains the circumstance that whilst in the purely tubal form the sac ruptures

very early—usually about the eighth week, and never deferred beyond the twelfth,—in the tubo-uterine variety it may be delayed much beyond this date." (Bland Sutton.)

"The sac of a tubo-uterine gestation may rupture in two directions. It may burst into the peritoneal cavity and be rapidly fatal, or into the uterine cavity and be discharged like an ordinary uterine conception. It is also an important fact to bear in mind that in this variety the sac does not rupture in such a way as to allow of the embryo being dislocated between the layers of the mesometrium." (Sutton.) Intra-peritoneal rupture is more rapidly fatal in the tubal form, because bleeding is more free.

It would seem that tubal pregnancy has some tendency to occur on both sides. Thus, Tait* has recorded the case of a patient who died of rupture of a tubal pregnancy on one side some time after successful operation for a similar condition on the opposite side. Herman,† three years after removing a ruptured tubal pregnancy on one side, diagnosed and removed before rupture a tubal pregnancy of the other side. Veit‡ records three examples in his own practice. Olshausen§ successfully removed a living child from a right tubal pregnancy in a patient on whom he had previously operated for left tubal pregnancy. Other cases are recorded by Lusk.

Kussmaul held that many cases of so-called tubal fœtation are really instances of gestation in the rudimentary horn of a bicorned uterus. He collected thirteen cases of this sort, all of which died of rupture between the fourth and sixth months. Parry and others consider that Kussmaul overestimates the frequency of cornual gestation; and even if it were more common than is generally supposed, it need not result in rupture. Missed labour is a more frequent result of such pregnancies.

Progress of Gestation.—If rupture of the sac does not prove fatal before the fourth month, the pregnancy in most cases goes on to full term. If the ovum remains in the tube, the tubal

* *Brit. Med. Journ.*, 1888, i., 1001. † *Brit. Med. Journ.*, 1890, ii., 722.

‡ *Zeit. f. Geb. u. Gyn.*, xvii., 335.

§ Abstract from *Prager Med. Woch.*, No. 8, 1890, in *Internat. Journ. Med. Sci.*, 1890, vol. c., p. 199.

walls are greatly thickened and the muscular layers much hypertrophied. This muscular envelopment is much greater if the ovum lies partly inside the uterus. In some cases a part of the ovum may be within the uterine cavity: thus, the placenta has been found inside the uterus, while the foetus lay in the tube; or part of the child may be intra-uterine and part intra-tubal; or the placenta may be wholly situated in the tube, while the child is inside the uterus.

Should the placenta, after rupture of the cyst and escape of the foetus, retain its attachment, we may have the foetus covered with its envelopes developing in the abdominal cavity, while the placenta in the tube supplies it with nourishment. The envelopes may be wanting, and the foetus is then surrounded by an adventitious cyst composed of organised inflammatory material. Should the placenta be partly extruded with the foetus, it may adhere to any contiguous organ: omentum, stomach, large and small intestine, abdominal wall, and an infinite variety of combinations of these, have been found serving as placental sites. The sigmoid flexure of the colon is, as might be expected, a favourite situation. In a general way we may expect the ovum to fall somewhere into Douglas's pouch, matting together whatever structures may be encountered there. Thus it happens that the posterior surface of the uterus is frequently involved. As the ovum grows, the uterus is usually elevated and pushed forwards; it is always enlarged, generally to a size corresponding to the third or fourth month of gestation, and may or may not contain decidua. Complete detachment of the placenta causes death of the ovum.

As regards the extra-peritoneal variety, where the foetus grows between the layers of the broad ligament, a most important study has recently been made by Berry Hart and J. T. Carter of Edinburgh,* from frozen sections of two specimens. One of the specimens was a four and half months' gestation *in situ* in the bony pelvis; the other an entire cadaver with advanced abdominal gestation. The latter showed a Fallopian pregnancy developing to an extraordinary extent between the layers of the broad ligament, continuing this mode of growth till it had

* *Edin. Med. Journ.*, 1887, vol. xxxiii., p. 332.

stripped off the peritoneum from the uterus, bladder, and pelvic floor, until it became in great part surrounded by a peritoneal capsule derived from these organs. The growth was, in fact, entirely extra-peritoneal; the extra-peritoneal tissue, with its blood-vessels, was practically the material part of the placenta. The authors hold that the following varieties of extra-uterine gestation, or rather development, have been demonstrated: Tubal; Tubo-ovarian; Sub-peritoneo-pelvic; Sub-peritoneo-abdominal. The last two varieties may be later developments of the first.

If the mother survives the death of the child at term, certain changes take place in the retained foetus which vitally influence the progress of the case. In the first place, the child may remain quiescent in its envelope, the liquor amnii being absorbed, and the cyst-wall contracted around it. This usually results in "mummification." Certain atrophic or heteromorphic changes may now take place. The whole ovum may become cartilaginous, or it may become infiltrated with calcareous matter (when it is known as a lithopædion); or it may undergo transformation into the peculiar material known as adipocere. In any of these conditions it may remain for long periods, sometimes for many years. This is the most favourable termination.

On the other hand, decomposition may take place, and suppuration is set up in the sac. Here the termination is the ordinary one for all abscesses—rupture. The rupture rarely takes place into the abdominal cavity; but usually, after formation of adhesions, into one or other of the contiguous hollow viscera, bowel or bladder, or through the abdominal wall. The following table, modified from Webster's,* summarises in a convenient form the main features, pathological and clinical, of ectopic gestation. It is premised that in every case gestation is primarily tubal :—

* *Ectopic Pregnancy*, 1895, p. 30.

Ectopic Gestation.

A. AMPULLAR. Gestation beginning in the ampulla of the tube.

I. *Persisting.* Rarely goes to full term.

II. *Rupture.* The usual result.

1. *Into Broad Ligament.*

- (a) Gestation continues there.
- (b) Secondary rupture into peritoneal cavity.
- (c) Gestation terminates—
 - (a) By formation of hæmatoma.
 - (β) By suppuration.
 - (γ) By mummification, adipocere or lithopædion formation.

2. *Into Peritoneal Cavity.*

- (a) Gestation continues, the placenta remaining in the tube, the foetus and membranes being in the cavity.
- (b) Gestation terminates—
 - (a) The patient dying from hæmorrhage or shock.
 - (β) By absorption of mass.
 - (γ) By mummification, adipocere or lithopædion formation.

III. *Destruction of Gestation.*

- 1. *By Tubal abortion.*
- 2. *By formation of mole.*
- 3. *By hæmato-salpinx.*
- 4. *By suppuration.*
- 5. *By absorption after early death.*

B. INTERSTITIAL. Where the gestation develops in the interstitial portion of the tube.

I. *Persisting.* The gestation may go on to term.

II. *Rupture.*

- 1. Into the peritoneal cavity.
- 2. Into the uterine cavity.
- 3. Into both the peritoneal and the uterine cavities.
- 4. Between layers of Broad Ligament.

III. *Destruction of Gestation* and regressive changes in foetus and envelopes.

C. INFUNDIBULAR. Where the gestation is in the outer end of the tube. The ovary may form part of the wall of the sac.

SYMPTOMS AND DIAGNOSIS.

Following Parry, we may best study the symptoms in three stages: the first, up to the period of probable rupture of the sac—that is, to the end of the fourth month; the second, to the period of spurious labour; the third, from the end of the labour and the death of the child onwards.

During the first month or six weeks the symptoms may be those of ordinary pregnancy, but more than usually variable and indefinite. At the end of this time signs, often urgent and unmistakable, appear to warn the patient that all is not right. A sudden attack of violent colicky pain in the hypogastrium, accompanied by profound prostration or even syncope, is usually the first sign of evil import; this may last for a few hours or even days. The pain disappears as suddenly as it came on, and the patient regains her usual health. In a few days or weeks, however, similar symptoms recur, and they continue intermittently till the third or fourth month.

Such attacks usually come on after severe exertion, and are probably due to contractions in the wall of the sac, or to its straining against over-distension. Peritonitis is curiously absent, as proved by the rapidity with which recovery takes place.

During this stage a frequent occurrence is the discharge of dark clotted blood from the uterus. This takes place at irregular intervals, lasts for uncertain periods, and disappears as capriciously as it comes. Sometimes pieces of the decidua are found in the discharge.

A vaginal examination at this period reveals some enlargement of the uterus, with displacement, usually forwards, sometimes lateral as well, and great tenderness in the pelvis. The enlargement is not so great as we should expect in a normal gestation of the same standing; but this sign is not trustworthy, because it is so difficult to decide as to the duration of extra-uterine pregnancy. In the region of the greatest tenderness, usually behind the uterus, we may expect to find the tumour.

To make a satisfactory examination, an anæsthetic is usually necessary. A rounded, soft, boggy or fluctuating mass, of size corresponding to the period of gestation, is usually all that can be made out. In this stage the sign of ballotement cannot be elicited.

When quickening has taken place, the symptoms undergo a marked change. The attacks of colic diminish or disappear. Metrorrhagia either disappears or becomes unimportant. Fœtal movements are now detected, often exaggerated and usually on one side. The abdomen perceptibly enlarges, more on one side than the other. The uterine displacement becomes more marked, and is attended with elevation and fixation. Often the fundus uteri can be felt through the abdominal wall, over the pubes and to one side.

Through the vagina the tumour will now readily be felt, rounded, fluctuating, and containing a hard body in the midst of its fluid. Frequently the cyst-wall is so thin that the outlines of the fœtus can be made out with great accuracy. Passing the catheter, by telling the position of the bladder, may be of assistance: the uterine sound is not to be used, except in cases of urgency. Symptoms of irritation of the bladder are frequently present. Irritation of the rectum is more common, because the sac is often adherent to its walls; physical obstruction to the passage of fæces may be caused by the bulk of the tumour.

The end of this period is signalised, at the full term, by a spurious labour. The pains are almost identical with those characteristic of the first stage of normal parturition, and may deceive physician as well as patient. They differ from those of natural labour in that they do not steadily increase in severity, but have irregular aggravations, with remissions and intermissions. Finally they pass off altogether, after continuing over many hours or even days.

Concomitantly with the fruitless labour there goes on a discharge of blood from the vagina. If the decidual membranes have not previously been expelled, they are expelled now. When the sanguineous discharge ceases, another comes on which is analogous to the lochia.

It would seem that the uterus is mainly to be credited with the causation of these pains. Only tubal sacs have muscular fibres; but labour comes on all the same if the gestation is ventral. Mr. Scott,* during coeliotomy in a case, found the uterus contracting strongly and regularly, as in normal labour. The false labour also seems to have little influence on the sac; at least, it rarely ruptures or becomes inflamed. A few cases of rupture, with escape of the child into abdomen, rectum, or vagina, are recorded.

A curious sequence to this labour is death of the child. Just before it dies it frequently struggles violently for some time, causing great distress to the mother. When the child dies the abdomen diminishes in size, from absorption of the amniotic fluid. If the child is to remain quiescent, or undergoes atrophic changes, the diminution remains, and becomes more marked; if decomposition takes place, the sac refills, and its distension is accompanied with signs of internal suppuration, often of a very acute nature. Special symptoms may be referred to special organs through which the abscess is preparing to discharge its contents. In the rectum, tenesmus, with a feeling of weight and diarrhoea; in the bladder, irritability, with frequent micturition and signs of catarrh; in the vagina, fulness, pain, heat, and a leucorrhœal discharge, indicate the site of election for bursting. One case, at least, has burst into the stomach. Sometimes the opening is double—as, for instance, through rectum and abdominal wall.

Signs of Rupture of the Cyst.—In about one-half of the cases rupture of the sac takes place before completion of the full term. This is attended with symptoms of a most serious and alarming nature. Premonitory attacks of griping pain in the lower abdomen are followed by a sudden seizure of agonising pain, often with a sense as of something having given way; and this is rapidly followed by prostration and collapse. During this period of "abdominal collapse" one fainting fit follows another; and the patient either dies very soon, or slowly rallies to an attack of peritonitis. Frequently, considerable quantities

* *Lond. Obstet. Soc. Trans.*, 1873, vol. xiv., p. 313.

of blood are effused; in these cases, the peritonitis is late in coming on, and is not very acute.

The special symptoms of pregnancy in a hernial sac, and of twin foetation—one inside the uterus, and one outside, or both outside,—being simply cumulative of individual symptoms, need not be discussed.

INDICATIONS TO OPERATE.

Extra-uterine pregnancy may be regarded as among the most deadly of diseases. Nearly three-fourths of all cases die; and more than one-half of these deaths is from rupture of the cyst. Parry writes: "Recovery is so rare after rupture, that the physician has no right to allow the fact that it *may* occur to influence him in deciding upon a plan of treatment."

For such a disease, therefore, no half-hearted or tentative measures are to be tolerated. In some of its aspects it is as dangerous as hæmorrhage from an artery of the second magnitude; in others, it may rank with strangulated hernia; while under its most favourable conditions, it is fraught with an insecurity which at any moment may develop into acute danger.

Parry's statistics of 500 cases of extra-uterine foetation give a mortality of 67.2 per cent. In 336 cases the causes of death were mentioned. The most important are:

Rupture of Sac	174
Exhaustion	54
Peritonitis	24
Pregnancy	16
Intestinal obstruction	8

To these Lusk* has added 103 cases, occurring between 1875 and 1886, excluding cases of rupture in the early stages. Of 29 cases of abdominal pregnancy terminating in fistulous openings, 9 died. These, it must be remembered, are often regarded as examples of spontaneous cure; and if to the actual high mortality is added the probable continued impairment of health or comfort, it will be evident that spontaneous discharge

* *Brit. Med. Journ.*, 1886, vol. ii., p. 1083.

of the fœtus is not a termination to be hopefully anticipated. Eight cases died before fistula had formed, at periods varying from 8 months to $1\frac{1}{2}$ year. Of 52 cases of coeliotomy performed at varying periods after death of the fœtus, 37 recovered and 15 died. Of the fatal cases, only three—all cases of free hæmorrhage—could be attributed to the operation. In all the others, the cases were almost hopeless at the time of operation; as Lusk remarks, "the resources of surgery are rarely successful when practised on the dying."

Harris of Philadelphia has investigated the mortality of primary coeliotomy in cases of extra-uterine pregnancy. Primary operations he reckons as those performed, not only while the fœtus is living, but after it has reached a viable period of gestation—thus adopting the ordinarily accepted meaning of the term "primary." Of 25 cases collected, 23 mothers died and 18 children: 12 mothers died of hæmorrhage; and this hæmorrhage may occur during the separation of the placenta, as late as a fortnight after, as in Joseph Price's case. It is clear that if this class of operation is to be performed, some extraordinary means of controlling hæmorrhage must be adopted. Harris* recommends ligature of the vessels supplying the placenta, and its removal with the cyst if possible: if this is impossible, he recommends careful antiseptic treatment of the placenta, to prevent its decomposition.

Before setting down the indications for the major operation, it will be necessary shortly to estimate the value of certain minor proceedings. These are:—

Evacuation of the Liquor Amnii.

Injection of Lethal Substances.

Elytrotomy.

Application of Electric Current.

Evacuation of the Liquor Amnii.—Sir James Simpson,† in 1864, treated a case by puncturing the cyst through the vagina.

* *Annals of Surgery*, July, 1887.

† *Ed. Med. Journ.*, 1864, vol. ix., pt. ii., p. 865.

The child was not killed, and the mother died in three days. Braxton Hicks,* in 1865, by a similar method succeeded in killing the child, but the mother died of hæmorrhage. Two years later, and quite independently, Greenhalgh† was able to record a success. Dr. James of Philadelphia in 1867 had a success, which was near being a failure. A few successes and more failures have since then been recorded, and the plan has now been practically abandoned.

Injection of Lethal Substances into the Fœtus and surrounding Fluids.—Joulin, in 1863, is credited with the invention of this plan; but Friedrich, in 1864, was the first to put it into practice. Morphia was used, and the case was successful; but it is doubtful if it was one of ectopic gestation at all. Koeberlé followed with a success, and others are recorded. Matthews Duncan combined the plan with electricity; but, in spite of most persevering, skilful, and painstaking efforts, without success. At best this plan is uncertain, and it is dangerous.

Elytrotomy.—A good many cases have been recorded of operation by the vagina. Parry records 15 such operations, with six recoveries. King of Georgia, in 1817, was probably the first to remove an extra-uterine fœtus by vaginal incision. Bandl, in 1874, operated in the same way, but without success. Gaillard Thomas used the galvano-cautery for division of the tissues, and the patient narrowly escaped with her life. Herman‡ collected 33 cases of operation by vagina, and from his consideration of these drew certain conclusions which are worthy of being quoted: 1. The operation of opening an extra-uterine gestation sac by the vagina early in pregnancy, before rupture has taken place, by the cautery knife or otherwise, is a dangerous and unscientific proceeding. Abdominal section ought always to be preferred to this. 2. Soon after rupture has taken place, when

* *Lond. Obstet. Soc. Trans.*, 1866, vol. vii., p. 95.

† *Lancet*, 1867, vol. i., p. 359.

‡ *Brit. Med. Journ.*, 1887, vol. ii., p. 1213.

interference is called for to arrest hæmorrhage, abdominal section is more likely to succeed than vaginal. 3. When rupture has taken place, and the effusion of blood is followed by pyrexia, the indications for incision of the vagina are the same as those in hæmatocele from any other cause. 4. At, or soon after, full term, before suppuration has taken place, there might be conditions which indicate delivery by the vagina as preferable to abdominal section. These are: (*a*) When the fœtus is presenting with the head, breech, or feet, so that it can be extracted without altering its position; (*b*) when it is quite certain, from the thinness of the structures separating the presenting part from the vaginal canal, that the placenta is not implanted on this part of the sac, and it is not certain that the placenta is not implanted on the anterior abdominal wall. 5. If the child cannot be delivered by the vagina without being turned, abdominal section should be performed. 6. No attempt should be made to remove the placenta; the sac should frequently be washed out.

Broadly speaking, vaginal section may properly be performed under the above conditions when the state of parts—a thin sac and a presenting fœtus—invites the proceeding; or when nature is showing a disposition to make an opening through the vagina.

Robertson* of Oldham has successfully operated by dividing the perineum, and separating the walls of the vagina and rectum.

* *The Application of the Electric Current.*—Voillemier is said to have first suggested electricity; Cazeaux, after him, certainly did so. Bachetti of Pisa, in 1853, was the first actually to use electricity to kill the fœtus, and he was successful. Braxton Hicks, in 1866,† Allen of Philadelphia,‡ and others, by various methods of discharge, sought the same end. Gaillard Thomas, in particular, has paid much attention to this plan of killing the ovum, and has done much to improve and to simplify its application. He records several striking cases of success. Dr. Blackwood of Philadelphia,§ who has paid a good deal of attention to this

* *Brit. Med. Journ.*, 1886, vol. i., p. 288.

† *Lond. Obstet. Soc. Trans.*, 1866, vol. vii., p. 96. ‡ *Amer. Journ. Obstet.*, May, 1872.

§ *Phila. Med. and Surg. Rep.*, Sept. 3rd, 1877.

subject, strongly recommends Faradism, because it is controllable and acts with greater energy on the embryo. Believing that it acts by "tetanization" of the whole mass of the embryo, he would give the maximum dose at one sitting, prolonged for an hour or more. Galvano-puncture he considers waste of time. As now employed, electricity is usually applied by means of an induction apparatus; one electrode being placed on the most prominent part of the swelling in the vagina, and the other on the opposite side of the tumour over the parietes. Several applications are usually necessary.

Brothers* has collected 43 cases treated by electricity with two deaths. In four cases there were alarming symptoms, but the patients recovered. In two cases the fœtus was not killed; and in two suppuration of the sac with septicæmia occurred, the patients recovering after discharge of the fœtus, in each case through the vagina. In three of the cases contraction of the muscular layer of the Fallopian tube is said to have resulted in expulsion of the fœtus into the vagina. In some of the cases more accurate records might strengthen a belief in their authenticity; and among those that are well recorded, serious doubts must arise in the mind of the critic as to the validity of the diagnosis in several.

The position that electricity at present holds as a plan of treatment in extra-uterine fœtation is, that it is suitable only in the early stages, where it is not very dangerous and is followed by an encouraging degree of success. It must be noted that in these early stages diagnosis is uncertain; that the stimulation of an electric discharge may induce rupture; and that danger is not over when the fœtus is killed. It may not destroy the vitality of the placenta. Leopold's experiments† with the fœtus in pregnant rabbits would seem to show that the presence of a dead embryo in the abdominal cavity is a condition by no means free from danger; and actual results in the human female show the same thing.

Electricity is the best of all minor plans of operation; but it

* *Amer. Journ. of Obstet.*, xxii., May, 1888.

† *Archiv. für Gyn. and Med. Times and Gaz.*, 1882, vol. i., p. 41.

is not quite free from danger, it is not always successful, and in its limited application it enters into competition with coeliotomy in the same field where coeliotomy is most successful in primary results, and has also secondary results which are absolutely perfect.

A dispassionate consideration of the natural terminations of the disease, and of the effects of minor modes of treatment, drives one to the conclusion that, at all stages and under all circumstances (excluding the exceptional cases wherein elytrotomy is permissible), coeliotomy is the best treatment. In the early stages and before rupture, coeliotomy ought to be a very simple and successful proceeding. Veit, according to Harris,* has had seven operations, all successful. This has been called the "primitive" operation. Even during the alarming state produced by rupture, one surgeon (Tait) can show a record of 35 operations with two deaths. Between the fourth and ninth months the dangers to the patient are least: the next period of danger comes on at term. But if the risk to the patient during those five months is stationary, the danger of operation is weekly added to. The size of the fœtus increases the magnitude of the operation: if, as is likely, operation will be called for at the end of nine months, why wait for that time, when the dangers are so much greater? As a result of operation, a living mother and a living child can be credited only to six surgeons—Jessop of Leeds, A. Martin of Berlin, Eastman of Philadelphia,† Briesky,‡ Lawson Tait, and Olshausen (two cases).§ Perhaps a case of Braun-Fernwald,|| in which the child died of inspiration pneumonia, should be added to the successes. The wise practice is, that the less important life shall give way to the more important; that where sacrifice is called for, the child must give way to the mother. It happens that the period which is least dangerous to the mother is most dangerous for operation—speaking of the whole period as one.

* *Amer. Journ. Med. Sc.*, 1888, vol. xcvi., p. 264.

† *Amer. Journ. Obstet.*, Oct., 1888. ‡ *Wien. Med. Presse*, xlviii. 1887.

§ Abstract from *Prager Med. Woch.*, No. 8, 1890, in *Amer. Journ. Med. Sc.*

1890, vol. c., p. 199.

|| *Arch. f. Gynäk.*, xxxvii., 2.

But there is great difference in risk between an operation performed in the fifth month and one in the ninth. To the latter operation, where the child is living and viable, the name "Primary" has been given; the operation after full term, when the child is dead, has been called "Secondary." This nomenclature is misleading.

A Primary operation is performed at the worst possible period, as regards the safety of the mother. The results, so far, have been 31 operations with 25 deaths. Of the children, 16 lived; but the mortality among them during the first few months has been, as might be expected, high. In only six cases were both mother and child saved.* Indeed, if the child is viable, or even if the case has passed the sixth month, it is very doubtful whether it would not be better practice to wait till the period of false labour has passed by, and operate when the child is dead and the placental circulation has ceased. Of course, the case must be carefully watched, and any indication of change promptly met.

I would summarise the *indications for operation* by abdominal section, in extra-uterine foetation, as follows:

I. In all cases before the period of expected tubal rupture ($2\frac{3}{4}$ to $3\frac{3}{4}$ months), in fact, as soon as the condition has been discovered, should electricity fail to kill the ovum.

II. In all cases of tubal rupture, as soon as possible after the condition has been diagnosed.

III. In all cases up to the fourth month in which the foetus continues to live. Between the fourth month and the period of false labour, operation is not advisable.

IV. In all cases after false labour when the child is dead and the amnion absorbed. If suppuration takes place, operation is imperative: if the foetus is quiescent, operation, though advisable in the view of preventing further trouble, is not urgent. Absorption of amnion is waited for, because this indicates cessation of circulation in the placenta.

V. In all cases where the condition endangers the life of the mother.

Speaking broadly, operation ought not to be left as a last

* Harris, *Amer. Journ. Med. Sc.*, Sept., 1888.

resort: it ought to be ranked as a mode of treatment. The natural course of the gestation being intelligently foreseen, the best treatment ought to be available at all times, and not only when a catastrophe has taken place. The following case* points its own moral: "In October, 1875, three prominent Philadelphia obstetricians met daily in consultation for sixteen days over the case of a lady who was suffering the pains of false labour. . . . As they could not promise the husband that an operation would probably save the life of his wife, they waited for the time to come when they could do this; but, while doing so, and when the lady appeared to be getting better, she was suddenly seized with agonizing pains, followed at once by a state of collapse, and died in thirty minutes."

THE OPERATION.

Coeliotomy for ectopic gestation may be conveniently described as five varieties of procedure:

- I. Removal of the sac in the early months.
- II. Operation on account of hæmorrhage from tubal rupture.
- III. Operation while the child is alive, between the fourth month and the full term.
- IV. Operation for rupture of the sac after false labour.
- V. Operation with a dead or decomposing fœtus.

Removal of the Sac before the Fourth Month.—This operation—"Laparo-cystectomy," as it has been clumsily named—is of the simplest possible nature. It is essentially half the operation of Removal of the Uterine Appendages—or even less than this, for the ovary need not necessarily be removed.

The abdomen being opened, the situation and connections of the cyst are made out by two fingers passed into the cavity. The tumour is gently, and without unduly compressing it, drawn to the surface. A suitable site for a pedicle is selected, with or without the ovary included, according to the situation of that organ; ligatures are placed around it, and the tumour is cut away. In

* Harris, *Internat. Cyclop. Surg.*, vol. vi., p. 784.

most cases the Staffordshire knot will be found perfectly efficient. If the pedicle is very broad, an interlocking or a chain ligature may be substituted. The difficulty of diagnosis in the early stages before rupture must render this simple and satisfactory operation a rare one. A few cases of such operation, in which a correct diagnosis had not been made, have been recorded. Dr. Herman, of the London Hospital, has recorded a case* in which he correctly diagnosed and successfully removed a tubal pregnancy before rupture. Curiously enough, he had removed a ruptured tubal pregnancy from the same patient three years previously.

Operation for Hæmorrhage from Rupture of Tubal Gestation.—The primary object of operation here is to check hæmorrhage: with this we associate removal of extravasated blood from the abdominal cavity, extraction of the ovum, and also removal of the gestation-sac. The operation is performed while the patient is suffering from acute anæmia, possibly from profound collapse.

When the abdomen is opened, there will probably be an escape of blood, and the pelvis will be found more or less completely filled with blood-clot. Through the clot the fingers are pushed to the fundus uteri, and passed along each broad ligament embracing the Fallopian tubes. The site of gestation will be made out as a soft boggy enlargement of varying size and consistency, according as the ovum remains *in situ* or not. This is brought to the surface, and examined for a rent. A pedicle is fixed upon, ligatures are placed and tied in a suitable manner, and the whole sac is cut away. It is a better as well as a speedier plan to cut away the whole sac, than to endeavour to stem bleeding from the rent. Rarely does the complete ovum remain in the sac. Sometimes the placenta is found, while the foetus has escaped; and frequently the entire ovum is extruded, and lies amidst the blood-clots.

In a case brought almost moribund to the Bristol Royal Infirmary, where a complete operation was scarcely permissible on account of extensive old adhesions and the almost hopeless

* *Brit. Med. Journ.*, Sept. 27th, 1890.

condition of the patient, I rapidly placed forceps on the broad ligament and emptied the abdomen of blood, and waited to see if the patient would rally. There was no more bleeding; but the patient quickly sank. Two large bent Wells' forceps placed so as to surround the seat of hæmorrhage in the Fallopian tube will efficiently check bleeding while the patient rallies; and, indeed, if they were left on for twenty-four hours, the hæmostasis would almost certainly be permanent. But it is always best, if the patient's condition is not actually desperate, to remove the whole sac. It need scarcely be added that these operations must be performed with rapidity.

The extravasated blood is removed, at first, by the fingers or hand; then, by irrigation with a hot aseptic fluid; and finally, by sponging. These manipulations may demand prolongation of the parietal incision. When the cavity is dry, the wound is closed in the ordinary manner.

In many cases the indication to operate is simply an alarming pelvic hæmorrhage, and the diagnosis is frequently made only after operation. This is of no consequence in respect of treatment. The first indication of extra-uterine pregnancy may be this alarming hæmorrhage, following rupture of the sac: an intra-peritoneal hæmorrhage is most frequently of this nature, and we must promptly act on this presumption. No patient should be permitted to die while we wait for the evolution of diagnostic signs.

Operation between the Fourth Month and the Full Term, while the Child is Alive.—Although the operative details are essentially the same between the end of the fourth and the end of the ninth month, the operative results, so far as the mother is concerned, are very different. Apart from the shock of the operation, which is naturally greater after removal of a large foetus than of a small one, the chief danger—hæmorrhage—is increased with the age, and consequently the size, of the placenta. As already remarked, the primary operation, so called, for delivery of a viable foetus is not to be recommended, unless urgent symptoms on the mother's part call for it. And, generally speaking, the

condition of the mother, before the child is viable, is the call to operate. Diarrhœa; rectal or vesical tenesmus, irritation or inflammation; repeated attacks of pain; increasing weakness, and such symptoms, will usually be present in patients submitted to the operation here described.

The leading features of the operation are: incision of the sac (if there is one), removal of the foetus, cleansing the cavity of the sac, stitching its edges to the abdominal opening, and leaving the placenta to be separated by natural processes. But an endless variety in detail may be expected, demanding the exhibition of skill, dexterity, and tact on the part of the surgeon.

Thus, intestine may be found closely adherent to the sac at the site where it is most desirable to lay it open. Or, the placenta may be placed so that it is impossible to enter the sac from the front without passing through its substance. The surgeon must do his best to aim at a minimum of traumatic disturbance, with efficient technical completion of the steps of the operation.

Supposing, as in Jessop's case, that there is no sac, the operation is of the simplest nature. The foetus is removed, the cord is divided and tied, a drainage tube is placed with its extremity near to the attachment of the placenta, and the end of the cord is left hanging out of the wound. The subsequent treatment is most important. The abdomen is kept dry by repeatedly sucking out extravasated fluids through the tube; and, if necessary, abdominal irrigation is employed. The placental *débris* are thus removed: should the placenta, or portions of it, slough, it may be wise to enlarge the abdominal opening, to permit of its removal or facilitate its escape. In one of Olshausen's cases the placenta was not removed till after thirty-four days.

Should it seem feasible to remove the placenta without greatly adding to the risk, this may be done. Martin, in his successful case, did so. Olshausen also, in one of his successful cases, was able to remove the sac and placenta, which were upon the broad ligament. But in most cases, and particularly if the

sac can be shut off from the general cavity, this is not advisable. If there is no sac, to remove the placenta will rarely be possible, and still more rarely proper.

Whether the placenta may increase in size after death of the fœtus is not yet settled. Berry Hart* believes that "increased bulk of the placenta is produced only during the life of the fœtus and not after its death." He considers that the large bulk of the placenta is caused by extra-peritoneal burrowing and displacement with resulting effusions of blood and connective tissue formation, and that this occurs only during life of the fœtus. On the other hand, Tait, Herman, and Thornton believe that the placenta may grow after death; Bland Sutton considers it doubtful.

Intestine adherent to the sac at the point elected for opening must be separated with great care and delicacy. This is best done by peeling it off with sponges; if a cutting instrument must be used, and it is difficult to follow the line of attachment, it is wiser to borrow tissue from the sac than from the bowel. Indeed, it may be a good plan to cut out the adherent portion of sac and leave it attached to the bowel, using the opening so made for delivery of the fœtus.

"The golden rule for the operation is," says Tait, "to avoid touching the placenta." The site of placental attachment is not usually obscure in these cases. Dark coloration of the sac-wall, with the ordinary signs of abundant vascularisation, and, not infrequently, intimate adhesions to contiguous structures, mark the placental site. Every legitimate effort must be made to avoid it; but if it cannot be avoided, it must be cut through. As soon as it is cut, its edges must be grasped in large T-shaped compressing forceps; and hæmorrhage may be permanently checked by carrying a shoemaker's or chain suture around the opening, and including both placenta and sac. When the ends are pulled tight, this form of suture will cause puckering of the gap to any extent desired, when its edges may be conveniently fixed in the wound.

If there is much fluid in the sac, this may be removed, by

* *Amer. Journ. Obstet.*, 1892, xxv., 6.

tapping or aspiration, before the incision is made, so as to save future sponging. The incision in the sac is made preferably in the direction of the abdominal wound. But if avoidance of placenta or adherent intestine is gained by making the incision in another direction, this direction may be followed. When the fœtus is extracted the sac collapses, and there is no difficulty in bringing its cut margins to the surface.

During extraction of the fœtus the edges of the opening in the sac are pulled forwards by forceps, so as to guide the fluids over the parietes. The cavity is cleansed and mopped out, and the cord is left hanging out of the wound. The edges of the opening in the sac are carefully stitched to the skin at the bottom of the wound, leaving an opening large enough to admit the largest size of drainage tube, and along side of it the umbilical cord. It would be good practice to surround the cord with a roll of gutta-percha tissue. The abdominal incision is finally closed down to the attachment of the sac.

Sponging and sponge-packing will have been employed at every step where necessary, to soak up fluid or protect abdominal organs.

Supposing the sac is covered by peritoneum—that is, supposing the ovum has developed between the layers of the broad ligament—we may expect to find the whole pelvic peritoneum elevated, thickened, and vascular. Instead of the thin fibrous tissue, traversed by large vascular trunks, met with in adventitious sacs, we here have to deal with thick, succulent, cellular tissue, abundantly supplied with minute vessels. Hæmorrhage is therefore likely to be troublesome, on making the incision; but it may be controlled in the way recommended. In such cases, delivery by vagina may be substituted with least disadvantage.

Free drainage, combined with irrigation, and, if necessary, dilatation of the opening, to permit escape of the separated placenta, include the subsequent details of treatment.

Rarely is it advisable to attempt complete removal of the sac. In the early stages of ventral gestation, while the sac is small and its connections neither intimate nor numerous, it may

be possible to shell the whole out. In such proceedings, however, bleeding may be difficult to control, either because its source lies deeply in the pelvis, or because it arises from numerous points of adhesion to intestine or other important viscus.

Operation for Rupture during Spurious Labour.—Here the plan of operation is decided for us. The fœtus being removed, and the extravasated blood and other fluids having been mopped up, the rent in the sac is examined for bleeding points. Locking forceps are placed on these, and left attached. A deliberate examination of the state of parts is now instituted. If the rent is in front, the operation is concluded as if it had been intentionally made there, by suturing its edge to the parietal wound. If it is behind, or so situated that its lips cannot be brought to the surface, a variety of methods are possible. It is inadvisable to permit the discharges from the sac to escape into the abdominal cavity; therefore, the rent should, if possible, be closed, and an opening made in front, below the parietal wound. This opening need not be so large as if the fœtus had to be delivered through it; sufficient space to admit the drainage tube and the umbilical cord is all that is wanted. Through this opening measures may be adopted to close the rent, either temporarily by T-shaped pressure forceps, or permanently by a continuous suture through the infolded edges. The sac is then treated as if it had not been ruptured. It will always be advisable to place a drainage tube in the abdominal cavity, and retain it there for a day or two, until there is evidence that there is no leakage from the rent.

Operation with a Dead or Decomposing Fœtus.—This proceeding is usually called for after the period of false labour, when symptoms arise which indicate danger to the mother. The conditions which give rise to these symptoms are very varied, and the details of the operation will be similarly varied. In fact, to describe the average course of one operation, in the midst of the endless varieties met with, would be impossible. From

removal of a gangrenous sac containing a putrid ovum, with perhaps resection of bowel, down to simple opening and drainage of an abscess, we must be prepared for almost any contingency.

Thornton* succeeded, after much difficulty, in removing the whole gestation-sac as well as fœtus. The cyst-wall was rotten, and, during the manipulation necessary for separating the abundant intestinal adhesions, rupture took place, and clotted blood, followed by a withered fœtus, escaped.

Notta† records a case on which M. Boilly operated, and in which intestinal obstruction was present. The fœtus had been carried for eight years, and the cyst was very intimately adherent. A loop of intestine was found strangulated, and the constriction was divided. The patient died; and after death a second strangulation was found. A preparation in the Bristol Infirmary museum shows strangulation of a double loop of bowel by adhesions around a gestation-sac.

In Galabin's‡ case of extra-uterine and intra-uterine gestation combined, the sac was so friable that it could not be stitched to the abdominal wall; and death was probably caused by the uterus, in the premature expulsion of its own fœtus, contracting away from the extra-uterine placenta which was attached to its surface, and so causing hæmorrhage.

Breudel§ operated successfully on a case where there was absolute constipation for four weeks. In this case the fœtus was not decomposed, the placenta was almost separated, and the operation presented no serious difficulties.

Spanton|| operated successfully on a case in which symptoms of peritonitis had existed for two months. A macerated fœtus and putrid purulent fluid were found in the sac, and very extensive intestinal adhesions were present. Drainage of the abdomen as well as of the sac, and daily irrigation, were employed.

One of the most remarkable of these cases was operated upon with success by the late Dr. Angus Macdonald.¶ The

* *Obstet. Trans.*, vol. xxiv., 1882, p. 81. † *Prog. Méd.*, 1884, xii., p. 196.

‡ *Obstet. Trans.*, 1882, vol. xxiv., p. 81.

§ *Centralbl. f. Gyn.*, Oct. 13th, 1883, p. 649. || *Brit. Med. Journ.*, Jan. 12th, 1884.

¶ *Ed. Med. Journ.*, Feb., 1884, p. 697.

woman at the end of the sixth month was seized with dysuria and pain in the lower abdomen; three weeks later a sanious vaginal discharge appeared, with œdema of the left leg. Hectic supervened, and the patient was brought to a very low ebb. At the operation it was found that the cyst had opened into the intestine, and the fœtus lay, surrounded with fœculent fluids, in a sac, part of whose wall was formed by intestine. Resection of the semi-gangrenous gut was at once carried out, and the abdomen closed after being thoroughly cleansed. The patient made an excellent recovery.

In 1887 I had to operate on a patient in the Bristol Infirmary, with an extra-uterine fœtation, about five months after the period of spurious labour. The fœtus lay in its membranes quite free in the abdominal cavity; but adherent everywhere to intestines, and parietes. The adhesions were broken down with great ease, not a vessel had to be tied, and the operation was concluded without any difficulty whatever. The membranes were quite intact, lying closely over the limbs and trunk of the child. The head was putrefying. The placenta was firmly attached over the fundus of the bladder and was not disturbed. There was not a trace of fœtal sac. The fœtus appeared to be one of about the seventh month. The patient made an excellent recovery, the umbilical cord being removed with the aid of daily rotations.

In 1894 I removed from the bladder the limbs of a decomposing fœtus, and delivered through the fistula between it and the gestation sac a protruding iliac bone. I was tempted to remove the rest of the fœtus through the fistula, and did so; but the patient, already exhausted with pain and suppuration, died. Coeliotomy, if the patient will bear it, is usually the best proceeding, even in couch cases.

No two cases are alike, and no general rules can be laid down for their treatment. Litzmann has collected 33 cases, 24 occurring between 1870 and 1880; there were 19 recoveries.

Before laying open a sac which may contain very putrid material, the aspirating needle should be used, to draw off sufficient fluid to cause relaxation of the sac-walls, and to

permit of the site elected for opening being drawn to the surface by forceps. Sponge-packing around the sac should always be employed; and thorough cleansing of the abdominal cavity ought to be carried out. When the sac is empty, the fingers should be carried around it everywhere, to make certain that there is no strangulation of intestine. The placenta, unless it is loose or partially detached, ought not to be disturbed.

If there is a suspicion of general peritonitis, or if any of the fluids have escaped from the sac, abdominal drainage ought to be used, as well as drainage of the sac. Irrigation of the sac with antiseptic fluids is useful, both as helping to remove placental *débris*, and as protecting from septic absorption.

It is a great advantage in these cases to find that the placental circulation has ceased, because then that body can be removed without risk of causing hæmorrhage, or laying open maternal sinuses to the danger of septic infection. Unfortunately there are no means of ascertaining beforehand when the placental circulation has ceased. Experience is no guide; for, while Schroeder in one case found obliteration of the vessels three weeks after the death of the fœtus, Depaul, in another case in which fœtal death had occurred four months previously, found the placental circulation still going on, and lost his patient from hæmorrhage. After the child is dead, if there is no urgency we may wait; every week that passes adds to the probability that obliteration of the placental vessels has taken place. On the earliest appearance of troublesome symptoms, operation should be performed.

These operations, properly conducted, are not so fatal as might be expected. Thus, Gaillard Thomas saved four cases on which he operated; Tait has only lost one out of seven; and individual examples of most difficult and unpromising operations conducted to success are daily becoming more numerous.

Operation for "Missed Labour." Pregnancy in one Horn of a Bicorned Uterus.

Anatomical Conditions.

Diagnosis.

Operative Treatment.

Only a very few examples of this condition have been recorded, and still fewer operations. Some of the cases might be read as so-called interstitial pregnancies; that is to say, as pregnancies in that part of the tube which passes through the uterus. Others might have been true extra-uterine pregnancies, which had forced their way by ulceration into some part of the genital tract. But a sufficient number of cases have been recorded by competent observers to prove beyond a doubt that pregnancy may proceed to full term in one horn of a bicorned uterus, and that when labour comes on at term it may not result in discharge of the foetus. Angus Macdonald held that all examples of "missed labour" are probably cases of uni-cornual pregnancy. Whether this be so or not, it is certain that the anatomical and physiological peculiarities of pregnancy in one horn of a bicorned uterus will explain most cases of missed labour. If this is not a proved fact, it is certainly a good working hypothesis.

Anatomical Conditions.—In the cases of uni-cornual pregnancy which have resulted in missed labour, there has always been found either complete absence of communication with the general cavity, or only a small opening incapable of being dilated. The pregnancy takes place in an offshoot or diverticulum of the uterine cavity, so to speak; the ovum is completely surrounded by uterine muscular fibre; at no part is there tissue like the cervix, which will soften and dilate, and uterine contractions simply result in compression of the ovum. The fibres around the opening contract as much as the fibres at the

fundus; and their contractions effectually bar the way against delivery. In fact, the balance of muscular force is away from the genital canal; for the sac is usually thickest below, the reverse of what exists in normal gestation. In two of the published cases no communication was discovered with the general cavity.

The shape, attachment, and relations of the tumour are easily understood. It is not completely globular, but bluntly conical. Somewhere on the side opposite its uterine attachment and elevated as in normal pregnancy, are the uterine appendages—ovary, and Fallopian tube; and the round ligament may also be observed, elevated and thickened. The uterine appendages of the opposite side are low down, attached to the unaffected cornu. The tumour does not lie symmetrically, but towards the side from which it originates.

The contents of the sac are—the dead, and perhaps macerated, foetus; and fluids of varying character, according as to whether decomposition has advanced.

Diagnosis.—The history of a pregnancy advancing to full term; a fruitless labour, followed by signs of death of the child; an obliquely-placed abdominal tumour, rounded, smooth, and movable, with a uterine cavity little or not at all increased in depth, ought to suggest uni-cornual pregnancy with missed labour. Occasionally there is a discharge of decidua from the unimpregnated horn at term, and menstruation may occur regularly from the time of labour.

A physical examination reveals a normal cervix; a uterus of normal depth, closely attached to the tumour, and pushed to the opposite side; and a tumour with the characters just described. The presence of a foetus is to be diagnosed by the ordinary means. In Litzmann's case, the foetal head was found resting on the pelvic brim. Finally, the uterus may be dilated, and an opening looked for in its interior. In Litzmann's case, putrid fluid flowed continuously from a very small opening.

Operative Treatment.—In all cases the only treatment is by operation; and the best operation is coeliotomy, with complete

removal of the sac and its contents. I know of only five cases of operation, the operators being Salin of Stockholm, Litzmann, Säger, Wiener, and Macdonald. The last operator has given a particularly clear and full account of his case;* and has, at the same time, summarised and reviewed other cases. The operation was practically identical in each case, and four of the five cases recovered. Wiener's case† occurred in the end of 1884, and was not known to Macdonald. He treated the stump by the intra-peritoneal method, and got a favourable result. Prof. Schultze of Jena‡ has amputated one half of a bicorned uterus in which the placenta was retained. The child was born at the seventh month. The midwife had torn away the cord in her efforts to remove the adherent placenta. The patient recovered.

The operation is of the simplest possible nature. The tumour is delivered through the incision, clamped by a wire *serre-nœud* at its neck, and cut away. The pedicle is trimmed and dressed exactly as in Porro's operation.

As the fluids in the cyst may be putrid, the tumour should, if possible, be delivered without being tapped. But, if the cyst is very large, there is no objection to removal of the fluids by operation, provided the site of puncture is carefully guarded. In every case, to prevent escape of fluids into the abdomen, amputation should be made between two clamps or compression forceps.

* *Ed. Med. Journ.*, April, 1885. † *Archiv. f. Gynäk.*, bd. xxxvi., heft. 2.

‡ *Deutsche med. Woch.*, Nov. 4th, 1886.

SECTION VI.

OPERATIONS ON THE STOMACH.

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OPERATIONS ON THE STOMACH.

A CONSIDERABLE number of operations are now performed on the digestive organs. Most of these are undertaken on account of some obstruction to the passage of aliment or excrement; and are chiefly of the nature of resections of new growths, removal of various causes of obstruction or strangulation, and the establishment of fistulæ above constrictions which prevent the discharge of excrement.

For the performance of these operations, the surgeon must be familiar with a number of special technical manipulations, some of them of great delicacy. It is essential also that he should have an acquaintance with the topography of the viscera, not only anatomical, such as may be acquired in dissecting-rooms, but also practical, such as may be picked up in the dead-

house. The fingers, inserted through openings made in the parietes, are made to explore the cavity in all directions, giving a practical and tactile acquaintance with the position of the viscera, as well as with their consistency, shape, distance from the surface, and many other peculiarities. I would strongly urge the importance of this post-mortem study of the abdominal viscera by touch. There is no substitute for it but great practice in operating; and the experience so gained is liable to be costly to the patients. Every operation ought first to be performed on the cadaver.

I believe it is not generally appreciated how much of the abdominal cavity may be explored by a single finger inserted through an opening an inch in length. In a subject of average size, through an opening midway between the pubes and the umbilicus we may examine the whole of the true pelvis, and the abdominal cavity as high as the kidneys laterally, and the greater curvature of the stomach in the middle line. With two fingers a greater distance may be reached. The topography of the abdomen, from a surgical point of view, is best learnt in this way. Anatomical knowledge tells us where to make an incision in order to reach a certain organ; but the educated fingers inserted through this incision must recognise the organ, and bring it within reach of the operator. The hollow viscera are not always to be found in their anatomical positions. Indeed, when there is occasion to operate on any part of the intestinal tract, the disease which necessitates operation will usually be found to have been a cause of displacement. This is another reason for the cultivation of diagnosis by touch.

The characters of the tissues themselves are peculiar and unique, from a surgical point of view. To deal with any part of some twenty odd feet of hollow tube containing septic material, and lying in a closed cavity which is perfectly aseptic but peculiarly amenable to septic influences, is a problem in practical surgery which it is not easy to solve. And in dealing with the walls of this tube, the material we have to work upon is not the most satisfactory for surgical manipulations.

In every operation involving a solution of continuity of the

digestive apparatus, special precautions have to be taken to prevent the escape of their contents into the peritoneal cavity. Its blood-supply is conveyed in a delicate meshwork which is easily torn across, and gangrene of portions of the bowel may be induced by injury to mesentery or omentum and, in certain situations, even to parietal peritoneum. Lastly, in the closure of wounds, we have to deal, on the one hand, with the thin serous and muscular coats, which are readily torn through by needles or sutures; and, on the other, with mucous membrane which secretes fluids inimical to the vitality of the uniting media.

Topographical and Surgical Anatomy of the Stomach.—The position of the stomach as ordinarily described in text-books is not consistent with that laid down by the accurate researches of Luschka, Braune, Warner, Lesshaft, and others. Nor are these more recent descriptions perfectly harmonious on all points. The stomach is a movable organ, varying its position within considerable and not very definite limits; and these changes of position are usually most marked under circumstances such as demand operation.

It is only when the stomach is empty that its surfaces are directed forwards and backwards, and its borders upwards and downwards. Leuf describes the stomach, when fully contracted, as being "tubular." Its external measurement is then no larger than a moderately distended jejunum; the mucous membrane is corrugated into deep folds, and the muscular coat greatly thickened. In this empty state of the stomach the pylorus is frequently found open, so that water poured into it may at once run into the duodenum. As it fills, the lower border not only descends in the abdomen, but also rotates forwards around the long axis of the viscus, thus bringing the anterior surface superior, and the posterior surface inferior. In some cases this rotation may be so considerable as to bring the lower border fully to the front, while the upper border is behind.

About five-sixths of the stomach lie on the left of the middle line, one-sixth or less being on the right. During distension the

cardiac extremity rises upwards under the diaphragm, increasing the size of the pouch, but causing little increase of the projection towards the left. The bulk of the organ lies directly behind the cartilages of the fifth and sixth ribs; the rest, with the pylorus, is situated in the epigastrium. Most observers place the pylorus exactly in the middle line; sometimes it lies a little to the right.

The anterior surface of the stomach is in relation with the diaphragm, with the under aspect of the left lobe of the liver, with the internal surfaces of the fifth, sixth, seventh, eighth, and ninth left ribs and their cartilages, and with the anterior abdominal wall. It is accessible on the anterior surface, where it is in contact with the parietes. The accessible area is in a triangular space bounded by the ribs, the edge of the liver, and a line, nearly transverse, which moves upwards or downwards according as the stomach is empty or full. When moderately distended, the lower limits of the stomach may be on a level with the tip of the tenth rib-cartilage; when empty, the stomach may disappear from this triangular area, and be completely retracted behind the bony margins of the upper abdomen. Tillaux points out that the tip of the ninth rib-cartilage is prominent and movable, being attached to the eighth cartilage by a short ligament. It is known by its prominence, and by a sense of grating which it gives when it is rubbed on the upper cartilage. He would make the tip of the ninth rib a landmark for making out the lower limit of the stomach, and recommends it as a fixed point to reckon from in gastric surgery.

In many cases of distension of the stomach, the limits of the organ may be accurately mapped out by percussion; and other modes of assisting diagnosis, by artificially distending the cavity with gas or fluid, are employed.

The connections and vascularisation of the stomach are of surgical importance. The gastro-splenic ligament has more bearing on the surgery of the spleen than of the stomach. The lesser omentum, passing between the upper border of the stomach and the under surface of the liver, requires fuller notice. It contains in its folds the gastric artery, which is the

chief source of blood-supply to the stomach; and the hepatic artery, coursing along the front border of the foramen of Winslow, which gives off the important pyloric, gastro-duodenal, and right gastro-epiploic branches. The importance of these, both as supplying blood to the stomach, and as being in the region of certain surgical operations on the pylorus, is self-evident. The portal vein and the common bile duct also lie in the lesser omentum.

The neighbourhood to the pylorus of the vena portæ, the pancreas, the splenic vein, and the neck of the gall-bladder, must be borne in mind during surgical manipulations.

The attachment of the great omentum to the greater curvature of the stomach is also of surgical importance. It requires division in circular resections of parts of the stomach, and in such operations as may be performed on the posterior surface of that organ. The transverse meso-colon itself is not beyond the reach of danger in operations on the pylorus; and as it contains between its layers the vessels which supply the transverse colon, any wound of it is fraught with risk to the vitality of that bowel. This, however, is not likely to take place unless adhesions exist, binding the parts together, and the pylorus is displaced downwards. In no fewer than five cases has gangrene of the colon resulted from injury to the meso-colon.

The vascular anastomosis around the stomach is so free that gangrene of portions of its walls need not be counted among the risks of operation. It may be as well, where a choice is given, to make an incision along the course of the chief branches—that is, transversely to the long axis; but this is not of great importance.

The operations performed on the stomach are the following:—Gastrostomy, or the artificial formation of a fistula for the introduction of food; Gastrotomy, incision of the walls of the stomach for the removal of foreign bodies or tumours; Gastrorrhaphy, or operative closure of a fistula, or ulcer, or wound; and Pylorotomy, partial gastrectomy, or excision of portions of the stomach for new growth. Certain operations

for pyloric obstruction are described; such are Pylorodiosis, or operative dilatation of the pylorus; Pyloroplasty, or operative enlargement by incision; and Gastro-enterostomy, or the formation of a fistula between stomach and intestine. Besides these, the operative proceedings which may be called for in Gastric Ulcer and its complications are described in this section.

Gastrostomy.

History.

Conditions for which the Operation may be Performed.

Cancerous Stricture of the Œsophagus.

Cicatricial Contraction of the Œsophagus.

Obstruction from Growths Outside.

Malignant Disease in Pharynx and Mouth.

Ulceration of Œsophagus.

Congenital Closure of Œsophagus.

Diverticulum.

Diagnosis of Œsophageal Obstruction.

Mortality and Appreciation.

The Operation Described.

Preparatory.

Parietal Incision.

Fixation of Stomach.

Opening the Stomach.

Feeding.

Modifications in Method.

Witzel's Method.

Frank's Method.

Paul's Method.

Gastrostomy (γαστήρ—stomach, and στόμα—mouth) is the establishment, by operation, of a fistula through the abdominal and gastric walls for the purpose of introducing nourishment.

History.—In 1837 Egebert (or Egeberg), a surgeon in the Norwegian military service, read a paper before a medical society in Christiania in which he strongly recommended the practice of this operation for stricture of the œsophagus. He based his recommendation on the frequently successful results of the treatment of wounds in the stomach, and on the proved compatibility of gastric fistula with healthy existence. He described the operation with great minuteness, and with a scientific foreknowledge which leaves little to be added to the modern

descriptions of it. He even advised preliminary suturing of the stomach to the abdominal wall (since called Howse's method), so that adhesions might form before the opening was made. This, however, was then a recognised procedure in the opening of cysts of the liver and other organs. Egebert's paper was not published till 1841.*

About this time Blondlot, in his investigations on the process of digestion, had succeeded in forming gastric fistulæ in the lower animals. A little later, Watson, reasoning on the same lines as Egebert, sought to justify gastrostomy in insuperable contractions of the œsophagus. All this was speculation: no one had as yet performed the operation.

To Sédillot, who, in 1846, came forward in strong advocacy of the procedure, is due the merit of having first performed the operation on a human being. He gave it the name "gastrostomy." His writings exhibit the practical knowledge of the trained surgeon and anatomist, and they are brimful of earnest enthusiasm. The indications for operation he considered to be so straightforward and so favourable, that he expressed surprise that no one before him had suggested it. Apparently, therefore, Sédillot was ignorant of Egebert's proposal. In his indications for operation he includes a wide range of diseases. Besides stricture, he includes congenital absence of the œsophagus; tumours in the neighbourhood of the œsophagus and pressing upon it; tumours of its walls; and even wounds, ulcers, and inflammatory softenings, where the result to be attained was merely temporary rest. In one of his papers he records, in support of the operation, successful experiments upon animals. Individual surgeons, and on one occasion the united opinion of a whole society, were, however, against him. In 1839 he had performed his first operation on a man far gone with cancerous stricture, with a fatal result in twenty-five hours. In 1853 he again operated with fatal result after ten days. A third case, also fatal, is recorded in his work on *Operative Surgery*. In spite of these failures and of much opposition, Sédillot maintained the propriety of the operation.

* *Norsk Magazin for Lægevidenskab.*

Streubel, while objecting to the operation for cancerous stricture, considered that it might be justifiable in cicatricial contraction; but he did not operate. In 1853 Fenger, quite originally, and after careful preparation, operated with fatal result after fifty-eight hours. Nélaton, in his work on *Surgical Pathology*, speaking of the operation, advises that it should be performed in two stages, and that it should be limited to cases of uncomplicated cicatricial contraction of the œsophagus in young subjects.

The operation continued to languish. In 1858 Cooper Forster of Guy's Hospital operated for the first time in England, but without success. In 1859 he again operated, with like result; and one or two isolated cases occurred in the next few years. Among those who favoured the operation, the opinion was very generally held, that it ought to be restricted to cases of cicatricial contraction. Günther and Gross, in particular, identified themselves with this view. In 1866 Bryant and Curling operated, both without success. Indeed, with the exception of a partial success by Küster of Berlin, no satisfactory result was achieved till 1874, when Sydney Jones of St. Thomas's Hospital performed his third operation.

From this time the operation rapidly advanced in success and repute. The improved results arose partly, no doubt, from earlier operation; but chiefly from a better understanding of the technics of abdominal surgery. What influence the general modern practice of operating in two stages, as originally suggested by Egebert, advised by Nélaton, and independently re-introduced by Howse, may have had upon the operation, it is difficult to say. Zesas,* whose monograph on Gastrostomy is one of the most important which have yet appeared, is not in favour of the operation in two stages. He considers that it interferes with success by unnecessarily prolonging the starvation and weakening the patient: the improved results he attributes to antiseptics. I may here say that I have come to the same conclusion. However performed, there is no doubt that the operation

* "Die Gastrostomie und ihre Resultate." *Archiv. f. Klin. Chir.*, 1885, bd. xxxii., heft. 1.

has now an assured foothold among legitimate measures of surgical relief.

THE AIM OF THE OPERATION.

The immediate purpose of gastrostomy is, to establish a fistula, which traverses the walls of the stomach and the abdomen, between the cavity of the stomach and the outer air. The remote and permanent purpose is to carry nourishment into the stomach through this fistula. The reason for the operation exists in some insuperable obstruction in the digestive tract above the stomach which prevents the introduction of food, or in some condition of the tract which renders the introduction of food dangerous to life. The whole motive is, therefore, to prevent death by starvation. In some cases the prevention of death may be nothing more than a prolonging of life, as in those cases where life is already doomed on account of malignant disease. In other cases, the operation may have results synonymous with permanent cure.

Conditions for which the Operation may be Performed.—The actual conditions for which the operation may be performed are the following :

1. Cancerous stricture of the œsophagus.
2. Cicatricial contraction of the œsophagus.
3. Obstruction by the pressure of growths outside the œsophagus.
4. Malignant disease in the pharynx of the mouth.
5. Ulcerative, chemical, or traumatic destruction of the walls of the œsophagus.
6. Congenital closure of the œsophagus.
7. Diverticulum of the œsophagus.

Cancerous Stricture of the œsophagus is nearly always of the epitheliomatous variety. Of 57 cases collected by Butlin, 53 were epitheliomatous, 2 were scirrhus, 1 was encephaloid, and 1 was colloid. It is most common in males after middle life. It would appear (though this has been disputed) that it is most frequently situated in the lower half of the tube. Out of 20 cases,

it was found in the lower and middle portions of the gullet in 14, in the middle in 4, and in the upper third in 2. Professor Harrison Allen,* from an analysis of a considerable number of cases, concludes that the parts most liable to stenosis lie behind the cricoid cartilage and the left bronchus. Morell Mackenzie found, out of 100 cases, that in 44 the disease lay in the upper third.† Butlin‡ says that while the disease is unusual in the middle portion, it occurs with almost equal frequency in the upper and lower halves. Scirrhus may extend into the œsophagus from the stomach.

The narrowing is caused partly by the ingrowth of the epitheliomatous nodules, but it is more of the nature of a want of distensibility than of actual constriction. The new growth infiltrates the tissues as they lie normally undilated, and prevents their becoming dilated by the passing food. Spasmodic contraction, with hypertrophy of the muscular tissue, increases the difficulty. The growth of the tumour is so irregular that the open passage is usually very devious. At parts there is ulceration, extending sometimes completely through the tube and causing perforation. Indeed, perforation is one natural termination of the disease; though starvation and hæmorrhage, perhaps, are more frequently the immediate causes of death. Not a few cases have died from perforation produced by the passage of bougies; the aorta, the left bronchus, and the pleura, have in this way been entered.

Fibrous or Organic Stricture, also known as cicatricial contraction, is usually a sequence of ulceration caused by the swallowing of caustic fluids or very hot water. It may follow other forms of ulceration, particularly the syphilitic. Constant traumatic irritation or injury, as in sword-swallowing, may also produce non-malignant stricture.

The stricture following the swallowing of caustic substances usually begins high up in the gullet, and extends a considerable way downwards. It is very rarely annular. The mucous membrane is replaced by a grey or bluish-grey tissue of a peculiarly

* Agnew's *Surgery*, vol. ii., p. 1019.

† *Dis. of Throat and Nose*, vol. ii., p. 88. ‡ *Operat. Surg. of Malig. Dis.*, p. 207.

hard and resisting nature. The muscular layer is rarely involved. Stenosis after syphilitic ulceration is usually high up, and presents characters very similar to those following traumatism.

The passage through the stricture is devious, but not to such an extent as in epithelioma. Before stenosis is extreme, a bougie passes down it with increasing difficulty as more of its length is engaged. Sacculation in this, as in the previous form, is often found in the gullet above the constriction.

Tumours outside the Gullet may press upon it to such an extent as to cause almost insuperable obstruction to deglutition. Such are: growths in the neck or thorax, aneurisms of the aorta or the innominate artery, and some diseases of the larynx. Dislocation backwards of the sternal end of the clavicle is said by Sir Astley Cooper to have been a cause of extreme dysphagia; and I have seen a malignant growth, apparently springing from the sternoclavicular articulation, produce great difficulty in swallowing. Most of these and similar cases are, however, usually amenable to other forms of treatment than gastrostomy.

Tumours in the walls of the œsophagus, other than cancer, are extremely rare. Fibroma, sarcoma, and lipoma are found both sessile and pedunculated. Polypoid growths are most common. A foreign body, becoming impacted and surrounded by inflammatory adhesions, may cause obstruction, but is best treated by other means.

Malignant Disease in the Pharynx or the Mouth is very rarely an obstruction to swallowing. Mr. Whitehead of Manchester has performed successfully the operation of gastrostomy for cancer recurring in the mouth and pharynx after removal of the tongue; and a few operations have been performed for primary malignant disease in the mouth and pharynx.

Ulceration of the Œsophagus which refuses to heal in spite of prolonged treatment may justify the operation, on the ground of setting the parts at rest. An extensive destruction of the mucous membrane, as a consequence of swallowing corroding fluids, may do away with the power of deglutition, or may render the performance of the act dangerous to life. In such a case, if the patient suffers from inanition in spite of rectal alimentation, opera-

tion may be indicated. In syphilitic and other forms of ulceration the operation may, on similar grounds, be called for.

Congenital Absence or Closure of the Œsophagus is sometimes described as an indication to operation. The condition is, however, so rare, and the chances of its being discovered in time are so remote, that, for this end, the operation is not likely to be frequently performed.

Diverticulum of the Œsophagus has in one published instance* been successfully treated by gastrostomy.

DIAGNOSIS OF ŒSOPHAGEAL OBSTRUCTION.

The subjective signs of stricture of the gullet are chiefly those of difficulty of swallowing. At first, with solid food, there is a sense of some impediment to deglutition, with uneasiness referred to the neck or chest. It is gradually found that comfort is attained only by swallowing small morsels. Soon discomfort merges into difficulty, and difficulty advances to impossibility as far as solid foods are concerned. Then liquid foods only can be swallowed. With these also difficulties arise. They are swallowed only in small amount, and quantities are returned after repeated and prolonged attempts at deglutition. A feeling of nausea, sometimes culminating in vomiting, is often present. At times there is considerable suffering, perhaps amounting to a sort of anguish, with palpitation and a sense of suffocation. All these symptoms go on increasing till absolute inability to swallow food of any sort is produced, and death from inanition stares the patient in the face.

Pain in the part affected, and radiating towards the stomach and the mouth, is frequently complained of. The pain is increased by spasmodic contraction of the parts during the attempts at swallowing. Tenderness on pressure may be present; and this tenderness is usually more marked if there is thickening of the outlying tissues.

In the intervals there is a regurgitation of mucus, mixed in

* Stockton and Roswell Park, *Internat. Med. Journ.*, Jan., 1894., p. 1124.

some cases with pus or blood. Such discharges are frequently most offensive; in advanced cases the fœtor is simply horrible. Signs of digestive disturbance, such as flatulence, colic, constipation, or diarrhœa, are always present.

With the progress of the disease, the patient rapidly and surely loses ground. He becomes thin, wan, and anxious; his strength leaves him, so that he cannot make the slightest exertion without feeling exhausted; his limbs swell when he stands, or even when he sits; and he dies of starvation, in a state of physical prostration and mental gloom which is most painful to witness. Nutrient enemas, even when selected and administered with the utmost judgment and care, seem only to prolong the agony.

The objective signs are obtained by the passage of bougies and by auscultation of the œsophagus.

Obstruction to the passage of the bougie is the final confirmation of stricture or narrowing of the gullet. The instrument must be soft and flexible, and it must be passed with great delicacy. Several varieties of suitable instruments are in use; none are superior to the soft French bougie *à boule*. I believe that passage of the œsophageal bougie, in cases of stricture, is not always regarded with the gravity which it demands. I was present when a patient dropped dead off a chair while a distinguished surgeon was passing the œsophageal bougie: an aneurism of the aorta was found ruptured. I have known of two others where death resulted from perforation of the pleura at the hands of skilled surgeons. The slightest force is therefore to be strongly condemned.

Some idea of the nature of the stricture may be derived from the passage of the instrument. Its position in the gullet may be deduced from the distance which the instrument traverses without being checked, as measured from the teeth. If the stricture is cancerous, blood or pus, or even small shreds of tissue, may be found on the instrument when withdrawn; if it is simply fibrous, the instrument is covered with mucus only. In fibrous constriction the bougie is grasped with increasing tightness as it is passed along; in malignant disease the

obstruction is suddenly met, and, once passed, does not produce increasing difficulty.

Further assistance in diagnosing the nature of the obstruction is derived from the history. In all cases this must be carefully gone into. The interpretations are obvious, and need not be particularised. Spasmodic contractions of the gullet as found in young hysterical females need only be mentioned as a possible, but improbable, source of error.

As a supplementary aid to passage of the bougie, we may employ the method of auscultation of the œsophagus as introduced by Hamburger in 1867.* Morell Mackenzie,† Clifford Allbutt,‡ Zenker,§ and others, have employed and favourably commented upon this method. Though its inventor claimed too much for it, there need be no dispute that by auscultation over the spine we can detect the existence of an obstruction to deglutition, and, within somewhat uncertain limits, fix upon its site. Familiarity with the normal sounds of deglutition must first be acquired in healthy subjects. The whole length of the gullet, from the fifth cervical to the ninth dorsal vertebra, must be examined with the stethoscope over the spine during successive acts of deglutition of the same substance, liquid or solid. The character of the sound it is impossible to describe: it is said to resemble the word "glou-glou" pronounced in a loud whisper. An obstruction to the descent of the food in the gullet is inferred if there is marked diminution or cessation of the sound at any part; if there are prolonged gurgling or clucking sounds; or if the sound, arrested at a given spot, passes upwards again as the material is regurgitated. After special training, diagnosis by auscultation may be satisfactory and final; with most, it is merely a confirmation of other methods. Probably most clinicians would agree with the opinion recently expressed by Ogston, that the value of auscultation is chiefly in showing delay in the downward passage of the material swallowed.

* *Klinik der Œsophagus-Krankheiten*, 1871.

† *Lancet*, May 30th, 1874. ‡ *Brit. Med. Journ.*, Oct. 2nd, 1875.

§ *Ziemssen's Cyclopadia*, vol. viii., p. 12.

The œsophagoscope is not of much practical value; its mirrors are obscured by the mucus which is abundantly secreted when the instrument is passed.

MORTALITY AND APPRECIATION.

Gross* and Zesas† have collected elaborate statistics of the results of gastrostomy. Gross has gathered together 207 operations: Zesas gives the results of 162 cases, and provides at the same time a short description of each case.

Zesas, who lays great stress upon antiseptics, divides the operative period into two eras—the pre-antiseptic and the antiseptic. Of his 162 cases, 31 belonged to the former period; and only one, at the end, was successful. In the antiseptic era there were 131 operations—104 for cancerous stricture, and 27 for cicatricial stricture. Of the first class, 87 died and 17 recovered—a mortality of nearly 84 per cent. Of the second class, 16 died and 11 recovered—a mortality of about 60 per cent. The chief causes of death were: exhaustion in 36, peritonitis in 20, and pneumonia in 10. The periods of dying are divided as follows: under 24 hours, 17 cases; under 30 hours, 69; between 1 and 12 months, 19; between 12 and 18 months, 1. So far as I know, the most successful operation for cancerous stricture is one performed by Dr. James Murphy, of Sunderland. His patient lived 403 days after the operation, which was not performed till obstruction was complete.‡

Gross gives for his 207 cases 61 deaths only, or a mortality of 29.47 per cent. At the date of the last reports, he reckons that these operations had prolonged life for an average of 82 days in each case. For cancer, 167 operations were performed, with 49 deaths (29.34 per cent. mortality): for cicatricial stricture, 37 operations, with 11 deaths (29.72 per cent). Peritonitis, pneumonia, and shock, were the chief causes of death. This shows results apparently much more favourable than Zesas quoted. Gross adds of cancerous stricture: "Of

* *Trans. Amer. Surg. Association*, vol. ii., p. 363. † *Loc. cit.*

‡ *Brit. Med. Journ.*, Oct. 28th, 1888.

the entire number, 117 died in one month; 4 were living, but how long cannot be determined; and 46 survived longer than one month—the average duration of life, after the stomach was opened, being 33 days." Speaking of cicatricial stricture, he says: "Of the entire number, 20 died within one month, and 17 survived upwards of one month—the average duration of life, after the stomach was opened, having been 295 days."

An examination of these figures, apparently irreconcilable, will show how difficult a thing it is to say what is, and what is not, a death from operation. To fix an arbitrary period up to which the operation is said to cause death, and beyond which the disease is blamed, is simply impossible; and nothing short of this would render statistics trustworthy. We are dealing with imponderable quantities. Death from peritonitis at the end of a week in a moderately well-nourished young patient with cicatricial stricture, is a very different thing from death in the same way in an old patient in the last stage of exhaustion with cancerous stricture. They cannot be classed together for comparison.

Statistics seem to prove little in the way of results, beyond the fact that the operation is systematically delayed too long. It would probably be no exaggeration to affirm that, at the present day, a skilled surgeon could operate on suitable cases with a mortality under 10 per cent. Looked at practically, the question is something like this: What is best for the patient—early operation, a ten per cent risk, a certain avoidance of death from starvation, and a probably considerable prolongation of life; late operation, and a risk rising up to or even beyond fifty per cent.; or no operation at all, with the certainty of death from starvation if he escape certain accidents?

The answer is widely different, according as the disease is malignant or non-malignant. In the case of simple stricture, successful gastrostomy saves life, and adds indefinitely to the span of healthy existence. In this sense the operation is as justifiable as any which receives the sanction of the profession. When other measures fail, gastrostomy gives the only chance of life: if it saved only ten per cent. of the cases, it would still be

justifiable, as much as ligature of the very largest arteries if the patient is bleeding from them. I conceive, therefore, that in every case of cicatricial stricture of the œsophagus, as soon as it becomes evident that minor measures are ceasing to be efficient, we ought to perform gastrostomy. And, further, the operation ought not to be delayed beyond the time when the health begins palpably to suffer. If the necessity for operation becomes apparent, the patient ought not to be deprived of the best chances of success.

In cancerous stricture the case is very different. Here gastrostomy is a procedure of the nature of colotomy for malignant stricture of the rectum, intended merely to prolong life, and to render it less uncomfortable. Theoretically, it ought to have a smaller mortality than simple stricture. While gastrostomy for simple stricture would be justifiable with a large death-rate, the same operation for malignant stricture would not be recommended if the mortality were excessive. What, in actual figures, would constitute an excessive mortality it is impossible to say. Indeed, to lay down any hard and fast line up to which the proceeding is justifiable, and beyond which it is not justifiable, would be absurd. It must be left to the judgment of the surgeon. In such a case, I am of opinion that considerable weight ought to be given to the desires of the patient, after an honest and impartial statement of the possible and probable results have been put before him. My experience is, that he elects not to be operated upon. If he can swallow even a little, he is loath to believe that he will not improve, and he puts off operation from day to day, till it is too late; when the power of swallowing has passed, and he is being fed entirely on enemata, he has already got so near to the inevitable end, that he desires nothing more than that it should not be much longer postponed. In some the love of life is strong, and it may be difficult for the surgeon to withstand entreaties to operate in a case where the prospects are all but hopeless. To dictate advice is impossible; the action of the surgeon will follow the leadings of his conscience.

The question of removal of the cancerous stricture (œso-

phagectomy) may be introduced as an alternative. Of the five cases of this operation collected by Gross, to which Butlin* has added a sixth, three died of the operation, and the others soon died of recurrence of the disease. Butlin concludes, in my opinion, rightly, that the operation has at present no *locus standi*, and that there is little prospect of our being able to perform it except in very exceptional instances.

It is necessary to state that certain surgeons of repute consider that gastrostomy ought never to be performed for cancer of the œsophagus. Gunther and Gallard consider the existence of cancer as an absolute contra-indication. Lagrange† thinks the operation ought to be limited to certain favourable cases. He argues that when complete obstruction by cancer has taken place, the neighbouring viscera will have been involved—a statement which is manifestly too sweeping.

The operation has suffered in two ways. It has too often been performed by unskilled operators, and it has been delayed too long in the large majority of instances. A fuller knowledge of the conditions surrounding the operation will no doubt partly remove these objections; more judgment will be exercised in the selection of cases, and more skill will be exhibited in the technics of the operation.

For syphilitic disease the operation has been performed at least twice, in neither case with success; and twice for obstruction produced by enlarged bronchial glands, with one success and one failure.

In cicatricial stricture in children, dilatation is particularly difficult, and operation is called for at an early period. The success, too, immediate and remote, is naturally greater.

THE OPERATION.

Any *preparatory proceedings* will depend on the method selected and on the condition of the patient. It simplifies the operative details to have the stomach distended. In cases where the patient can swallow, some bland, innocent drink may

* *Op. cit.*, p. 210. † *Revue de Chirurgie*, 1885, No. 7.

be given before operation. The employment of any of the numerous artificial methods of dilating the stomach, such as may be used in gastrotomy, is not advisable in this operation, except in certain cases of cicatricial stricture. The operation must be done with as little worry and disturbance to the patient as possible, and quickly as well: artificial dilatation, either before or during anæsthesia, is objectionable on both these grounds. Besides, the advantage of it is doubtful. We desire to place the sutures in the stomach where there will be least traction, and this may not be where the dilated stomach presents. If the stomach is full at the operation, it will be empty very soon afterwards. By placing the sutures when the stomach is empty, we see and know the worst that its contraction can do. The increased difficulty in operating refers only to the finding of the stomach; and, if the operator has that amount of tactile skill in the abdominal cavity which he ought to have, this difficulty is very small indeed. I should not, therefore, in the slightest degree add to the patient's discomfort by trying to dilate the stomach.

Before operation it will be wise to administer a specially stimulating enema containing an ounce of brandy.

The operation is conveniently described under three heads: (1) Making the parietal incision; (2) Suturing the stomach-wall to the opening; and (3) Opening the stomach.

The Parietal Incision.—Many forms of incision have been recommended and adopted. Sédillot used a cross incision below the xiphoid process. Fenger's incision, next introduced, made parallel, and near, to the left costal margins, is the one now most generally used. Sydney Jones made an almost vertical incision in a line drawn from the left nipple to the spine of the pubes. Küster incised the linea alba. Maury used a curved incision, with its convexity towards the middle line. Cooper Forster employed a vertical incision through the top of the linea semilunaris, and many English surgeons have adopted his plan. Howse recommends a vertical incision through the outer of the rectus—a method which has the advantage of

surrounding the fistula by muscular fibres, which in their contraction tend to close it. Girard* has suggested a method of increasing the sphincter action of the rectus by isolating two bundles of its fibres as thick as fingers, and crossing them so as to form a double loop round the opening in the stomach. Hahn† makes the opening into the stomach through the eighth intercostal space, having first entered the abdomen through an incision parallel with the lowest rib.

The actual line of incision followed would not seem to be of supreme importance. It must be as short as possible. A long incision unnecessarily weakens the abdominal wall, and has a tendency to permit subsequent protrusion of the stomach. It must not be too close to the ribs, as their movements during respiration disturb the wound and weaken or tear or stretch the peritoneal adhesions. Unless at least an inch of space is left between the edge of the wound and the costal margin, the upper lip of the wound protrudes, and the lower lip is drawn inwards. This last objection does not apply to the vertical incision. Then, again, it must be so placed that the margin of the left lobe of the liver does not press upon the sutures fixing the stomach to the abdominal wall. Now, the position of the margin of the left lobe varies. It may lie as high as the lower edge of the xiphoid process, or it may descend as low as the tip of the cartilage of the ninth rib. We may expect to find it lower than normal, as it falls downward on account of the hollow viscera being empty. In a case on which I operated the left lobe was greatly enlarged and its margin depressed through the presence of a shrivelled hydatid cyst in the right lobe.

The site of election must be as high up as possible, to avoid traction on the stomach; and it must be low enough down to be well clear of the margins of the ribs and the liver. The situation is decided better by palpation and percussion, than by anatomical landmarks. The retiring angle between the ribs and the edge of the liver is marked out, and a site is fixed upon at least an inch distant from both. At this point the fistula should be established. The incision, therefore, ought to extend equally

* *Wiener. Med. Presse*, 1888, No. 28. † *Centralbl. f. Chir.*, No. 11, 1890.

on both sides of this point—say, three-quarters of an inch on each side of it. (Fig. 99.)

The vertical incision has many advantages, more especially



FIG. 99.

Diagram to show Site of Fistula in Gastrostomy.

The opening is made at *a*, *b*, or *c*, according as the liver margin corresponds to the lines 1, 2, or 3.

after the fistula has been established. But the oblique incision is on the whole, perhaps, the better, and more particularly because it gives greater freedom during operation. Tillaux recommends, as an anatomical landmark, the tip of the cartilage of the ninth rib, which is separated a little way from the fixed cartilage above it, and can be diagnosed by the sensation of grating which is felt when it is rubbed on this cartilage. Landmarks taken from the linea semilunaris vary too much to be trustworthy. If the edge of the liver cannot be determined by palpation or percussion—a rare event—then the tip of the ninth rib-cartilage is, perhaps, the best landmark. But its position I have found, from repeated observations, to vary also.

The best incision for general purposes is

that shown in Fig. 100. It traverses the linea semilunaris,

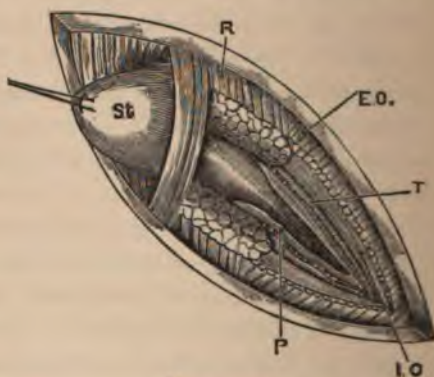


FIG. 100.

Drawing (life-size) of the incision for Gastrostomy (No. 1, Fig. 29; No. 12, Fig. 28).

R. Rectus Muscle. E.O. External Oblique Muscle. I.O. Internal Oblique Muscle. T. Transversalis Muscle. The lines leading to the letters are in the direction of the muscular fibres. P. Peritoneum. St. Stomach drawn through separated fibres of Rectus Muscle.

two-thirds being to the out-side and one-third to the inside, and dividing the rectus fibres. The skin and superficial fascia being divided, the outer margin of the rectus is noted and the division of muscular fibres is made. From half to three-quarters of an inch the incision passes through the rectus, and the rest of the incision is carried outwards through the oblique muscles and transversalis, being from an inch to an inch and a half in length. The whole incision will be from an inch and a half to two inches in length, sufficient to admit two fingers. The rectal fibres are divided obliquely. The external oblique, here thick and fleshy, will be divided almost transversely to the direction of fibres. The thin fibres of the internal oblique lie nearly parallel with the direction of the wound, and they may be separated with the forefinger. The fibres of the transversalis will be divided almost transversely. When the sub-peritoneal fat, here usually scanty and often absent, is reached, the peritoneum is pinched up with catch forceps, pulled to the surface, and divided in the ordinary way. If it is decided to seek for sphincteric action by muscle, a few bundles of the rectus may be separated by the forefinger right through to the abdominal surface of the muscle. The peritoneum is divided on the fingers to the whole length of the parietal wound.

If the stomach is distended, it may present at the wound, and this visible portion may at once be selected for the placing of the fixation sutures. Theoretical considerations as to the advisability of having the opening in a certain position of the stomach, preferably near the cardia and the lesser curvature, are of small weight, as compared with the importance of avoiding all traction on the stomach-wall.

In most cases, however, the stomach will be contracted, and situated high up under the diaphragm, while the colon or the omentum presents at the wound. It is quite possible to mistake the colon for the stomach: more than once the colon has been opened. To find the stomach, we may either pull it down by dragging on the omentum and the colon, or we may follow the suggestion of Legond, highly recommended by Farabeuf, and

use the under surface of the liver as a guide. The fingers are carried under the left lobe of the liver till they reach the vertebral column: they are then moved to the left, close to the diaphragm, when the lesser curvature will be felt. The stomach is always the highest of the hollow viscera. When recognised, a fold of its anterior wall is pinched up between the two fingers and pulled to the surface of the wound. The part which seems best to fulfil the double purpose of avoiding traction and providing a suitable spot for forming a fistula is then fixed upon, and the next step proceeded with.

Fixation of the Stomach.—The mode of fixing the wall of the stomach to the parietes will depend on whether the opening is to be made at once, or postponed for several days until adhesions have formed. The usual practice is now, in all cases, to follow the latter plan. Where the patient can afford to wait, this method has certain theoretical advantages; but it is by no means certain that it is always the better method in practice. A few continental surgeons of the highest repute advocate immediate opening of the stomach. They maintain that, the stomach being in most cases empty, the danger of extravasation is exaggerated; and that, if the sutures are properly placed, the danger of subsequent escape of fluids into the cavity is very small. Zesas and others have pointed out the great danger of withholding food from a half-starved patient upon whom has just been put the additional strain of a severe surgical operation. Exhaustion is the most common cause of death; and exhaustion is best combated by stomach feeding. The low vitality of the patient is against the rapid formation of strong adhesions. Kocher points out the risks of traction on an empty stomach, through interference with its circulation: this risk is obviated by immediate feeding.

The teaching of my experience has been that it is better always to open the stomach at once. If the method of fixation to be recommended is adopted, it is just as safe as the method in two stages. There is practically no risk of leakage from the gastric wound; the junction between stomach and parietes is

hermetically closed; the duration of the operation is scarcely measurably added to; nourishment can at once be administered; and finally, and this is no small matter to a weak and timorous patient, all operative proceedings are over before consciousness returns. Not all surgeons, however, hold this view; and, in some cases at least, valid arguments may be put forward in support of the two-stage operation.

The proceeding to be adopted, if we intend to postpone the opening of the stomach for a few days, may be simpler than if we desire to make immediate opening. Sédillot, in his second case, sought to cause adhesion of the stomach to the parietes, and at the same time to make the opening in the stomach by necrosis, by attaching a forceps to the stomach and leaving it there. This plan he did not like, and he proposed to transfix the stomach-wall by an ivory pin. Following a suggestion of Macnamara, Boyce Barrow and others have adopted this plan, employing harelip pins; and there is probably none better. Other plans of forming adhesions, by caustics, acupuncture and rows of needles, have been recommended and adopted; but none of them seem trustworthy. Howse is said to use clamp forceps padded with india-rubber; and his results are excellent.

In cases, therefore, where the opening of the stomach is to be postponed for some days, sutures need not be inserted. Mere apposition of the surfaces will result in the formation of sufficiently strong adhesions. To secure this end, the use of two thick harelip pins is by far the simplest plan, and perfectly satisfactory. The points of the pins should be rounded and smooth, and not cutting. They are carefully inserted under the serous and muscular coats of the stomach, in lines transversely to the direction of the wound; and they enclose a square area of stomach-wall, whose sides measure about three-quarters of an inch. In the centre of this square the opening is subsequently to be made. The ends of the pins are stuck into pieces of india-rubber, to prevent them from chafing the skin on which they rest. If the abdominal walls are thick, the pins may be bent downwards in the middle; in fact, a little downward curve will often be advantageous. If the pins are not removed, it may be possible

to open the stomach after four or five days, so perfect is the apposition which they give. Macnamara has supplemented this plan by the insertion of a piece of thick silver wire into a fold of the stomach, which was fixed to the skin of the chest.

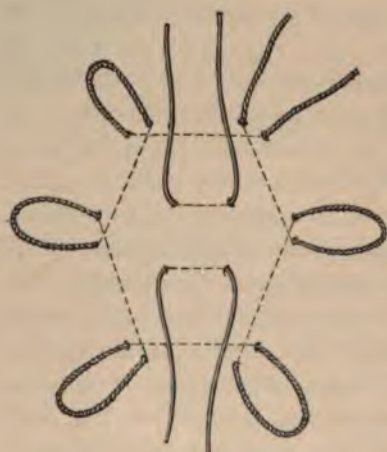


FIG. 101.



FIG. 102.

FIGS. 101 & 102.—Diagrams to show Fixation of Stomach to Parietes for Immediate Opening in Gastrostomy.

If it is decided to open the stomach within two or three days, it will be wise to make use of sutures. Chavasse, in a successful case, used only four sutures. Two or three sutures in addition to pins would be as good a plan as any to adopt, if the stomach is to be opened between the second and third day. For late opening the suturing has been overdone. In one case I used a deep continuous silver suture and four superficial silk sutures, with success. In another, four deep and four superficial sutures gave perfect apposition. Many similar plans have been successfully used—most of them, like mine, erring on the side of doing too much.

When the stomach has to be opened at once, or after a few hours, the method of suturing must be more elaborate. It must secure accurate apposition from the beginning all around, with-

out inflicting too much injury on the stomach, and without involving too large an area of its walls. Many plans are in

vogue; the following is, perhaps, as good as any. By it stomach-wall is kept in accurate apposition with parietal peritoneum in a continuous circle, and not at interrupted points. Firstly, following Bryant's excellent suggestion, insert two loops of silver wire near the spot where the opening is to be made. By these the stomach is manipulated during the process of suturing, and they serve to fix it when the opening is made. Then with a round needle, threaded with thick soft silk about a foot long, pass a continuous suture, in a circle of about two inches in diameter, under the peritoneal and muscular coats of the stomach. At every third quarter of an inch in the circle the needle is taken out and re-inserted; so that six or eight free loops, about an inch and a half in length, are left protruding on the serous surface.

FIG. 103.

*Eyeless Needle
for Inserting Sutures
as it is withdrawn.
One-third size.*

(Fig. 101.) Then at corresponding situations in the abdominal wall, a handled needle with a recurved hook instead of an eye (Fig. 103), or better still, a Reverdin's needle as modified by Brown (Fig. 104) is pushed through, and catches up the loops one after the other. As each loop is drawn through, a piece of rubber tubing is slipped under it. The loops are pulled with moderate tightness over the rubber tubing from each end of the incision. Finally, the ends of the silver sutures are hooked under the tubing, and serve to keep the exposed portion of stomach well up in the gaping wound. (Fig. 102.)



FIG. 104.

*Brown's Needle.
One-third size.*

If it is desired to provide sphincteric action, the loop or cone of stomach is pulled out between the outer fibres of the rectus separated by the forefinger (Fig. 100. Fixation by silk loops and tubing may be carried out in the same way. I am doubtful if this proceeding has more than a theoretical value. If the parietes are very thin and the stomach easily pulled forwards, then utilisation of some of the rectal fibres as a sphincter is to be recommended.

No mention is made of direct sutures between parietal peritoneum and skin or gastric peritoneum. The gastric surface is laid directly on the raw muscular surfaces and the parietal peritoneum is ignored—or if any attention is paid to it, it is to push it out of the way. The best and most abiding fixation is got when the stomach is directly implanted on the raw surfaces and left to adhere there. Adhesion is just as rapid, and it is far stronger. In my belief, dribbling from a gastric fistula is encouraged by bringing out parietal peritoneum and enveloping the stomach-walls in it. The peritoneum soon becomes mobile on the parietal wound; it is dragged inside, and with it the fistula in the stomach-wall. Such a fistula will, as time passes, always dribble. A mucous tube surrounded by muscle is, like the female urethra, watertight; an opening in a hollow viscus, with a fistula

leading through the cutaneous tissues, dribbles. It is not lined by mucous membrane, but by granulations. If a mucous tract between skin and stomach passing through the whole thickness of the parietes is to be provided, then the stomach-walls must be implanted on the raw incision.

That the firmest fixation is got by placing



FIG. 105.

Fistula in Gastrostomy at the end of ten days. The dots lie where there were soft sero-serous adhesions. The mucous membrane of the stomach reaches the skin level.

peritoneum in contact with raw surfaces, many observations in the fixing of hollow viscera and cysts to the parietes have proved.

Fig. 105 is a drawing from an actual case of gastrostomy which helped in the proof. It was got from a case in which, ten days after operation, death took place suddenly from perforation of the growth into the lung. Where peritoneum met peritoneum (dotted in the figure) the adhesions were soft and easily separated; where peritoneum joined raw incision, adhesion was so strong as to be quite inseparable. The specimen was, by mistake, placed in the macerating tub, and found there at the end of a week in a state of putridity. The intra-peritoneal adhesions had all disappeared; the junction of stomach-wall to parietal incision was as intimate as ever. In the mounted specimen it is impossible to say where stomach-wall ends and parietes begin. So intimate is the junction, the two cannot be separated by pulling with the fingers.

This simple expedient, of implanting that part of the stomach which is to form the fistula on the broadest possible surface of rawed wound, I regard as one of the crucial steps in the operation. To get a tube of stomach in the grip of parietal muscle and to keep it there, is the best preventive of dribbling from the fistula; and this is best secured by excluding parietal peritoneum and implanting the gastric surface directly on the rawed muscle of the parietes. Other and more elaborate devices for this purpose will be mentioned further on. The simple one described has, in my experience, been found perfectly efficient. The accompanying reproduction of a photograph (Fig. 106), interesting for other reasons than here concern us, shows an established gastrostomy fistula in which there was no dribbling, the skin being white and healthy up to the margin of the opening.

The parietal wound is carefully closed through its whole depth up to the seat where the fistula is to be formed. The muscles should be closely and accurately approximated, either by layer sutures of absorbent material or by mass sutures of silk-worm gut. The stomach-wall should be fixed in a position on the level of the skin, or even pouting a little. Wires or harelip-pins passing through the sero-fibrous coats and resting on the skin of the parietes serve to fix the apex of the gastric cone in the wound.

Opening the Stomach.—As already stated, I have come to the conclusion that it is nearly always best to open the stomach at the time of operation, and to feed the patient at once.

A minute opening is made by scissors or small knife, and through this a soft but thick-walled rubber tube of the size of a No. 8 English catheter is insinuated while on the stretch over the point of a probe. The tubing, being of larger calibre than the opening, stretches it, or at least fits accurately. A long round pin is made to traverse the gastric walls and the side of the tubing, thus fixing it in its place. About six or eight ounces of concentrated liquid food are passed slowly through the tube into the stomach; the tube is clamped and the wound dressed. Feeding may be repeated in three or four hours.

A food which I think highly of for this purpose is underdone meat pounded to a pulp, suspended in milk, and the mixture peptonised.



FIG. 106.

Case of Gastrostomy, showing position of fistula and feeding-tube in position. Stomach and intestines were dragged downwards.

The wound is carefully dressed, the dressings being fixed by strapping, through which the tube passes without being compressed. The dressing should be changed at least once in the first twenty-four hours: thereafter it may remain undisturbed for days.

When the opening is made a few days after operation, the procedure is complicated by the presence of a layer of lymph filling up the cavity between the lips of the wound and overlying the gastric wall. This may bleed if it is removed by forceps. In this case, it is not so easy to judge of the depth of the puncture to be made by the knife, and more disturbance of the parts may be caused than in immediate opening. But this matters little, for adhesions are likely to be firm. And if the plan of fixation by pins be adopted, the opening is a very simple affair. The insertion of tubing is conducted as above recommended; and it may be left in, with a plug or clamp to close it. It is fixed by a pin to pieces of strapping on the skin of the abdomen.

When the opening of the stomach is delayed, and the patient cannot swallow, *feeding by the rectum* must be instituted. This is a proceeding of great importance, requiring care both in the preparing and in the administering of the enema. Rectal feeding has received much attention of recent years, and many valuable preparations may be had. I believe that we do not always remember, in rectal feeding, that a certain quantity of fluid is an essential ingredient of all foods. The concentrated meat capsules and suppositories now frequently used should be supplemented by an injection once or twice daily of a pint of tepid water. A good enema for such cases I have found to be the following: an egg beaten up in six ounces of milk, with two or three teaspoonfuls of meat jelly, peptonised in the ordinary way, and administered warm, with or without the addition of brandy, every five or six hours. If the enema is passed in very slowly, it will usually be retained without difficulty. A large enema of tepid water to cleanse the rectum is necessary every day, or every other day. If some of it is absorbed, it will do good: starvation is robbed of half its terrors if plenty of fluid is given. Zesas and others who

have spoken of nourishing enemas in such cases are inclined to put very little value upon them. Under the best form of rectal alimentation yet devised, the patient steadily and surely loses ground. But the opinion that they help, if they are not all-sufficient, is too general to be delusive. In every case, rectal feeding must be used where feeding by the mouth is impossible; only, we must remember that it is at best an inefficient substitute for feeding by the stomach, and that opening must not be unduly delayed.

The mode of *feeding by the fistula* is of some importance. The food must at first be small in quantity, and of a nature to be readily absorbed, so as to cause the least possible physical and physiological disturbance. Peptonised milk, or pounded beef peptonised, are readily absorbed and nourishing. Starchy and fatty foods, which undergo digestion chiefly in the intestine, may be administered alternately with the more stimulating fleshy materials. "Often and little" has been the advice given; but, as previously remarked, not too often nor too little. Too frequent feeding may irritate the stomach, as well as the fistula, and too little will fail to support the patient's strength. Half a pint, slowly administered every four hours, would be an average quantity and frequency.

All foods introduced into the stomach should be of the temperature of the body. When the patient has got over the dangers of the operation, the food may be administered only at the ordinary meal times. It has been recommended that solid food should be masticated before being passed into the funnel which leads to the stomach. If there is a sympathy between the mouth and the stomach, causing the stomach to undergo certain physiological changes preparatory to the reception of food, this recommendation has a meaning beyond the gustatory. Cases are recorded where, by the help of ingenious contrivances, the patient has sat at table, masticated food, and passed it into the stomach-tube without shocking the susceptibilities of his companions. The patient will soon learn what apparatus is best for feeding; and how, in the intervals, the fistula may be most perfectly kept closed and

protected. Feeding by gravitation is usually the mode selected, and a pad of clean linen will, in most cases, efficiently guard the opening.

MODIFICATIONS IN THE OPERATION OF GASTROSTOMY.

Most of the modifications described have reference to the avoidance of leakage from the fistula. If the operation is done in the manner described, it is practically certain that there will be no leakage, and these more or less elaborate details need not be adopted. The condemnation that Meyer* applies to all ordinary methods because of the leakage which follows them is perfectly just, and warrants him in his strong commendation of certain methods designed to remedy this defect. It is suggestive that in all these operations it is taken for granted that the parietal peritoneum must be brought into the wound area and stitched to stomach or skin. That the laxity of attachment thus induced, and the indrawing of the stomach-wall, might be the cause of dribbling through the fistula does not seem to have suggested itself. It is certain that if the tube of gastric wall has that immobility of attachment which can be got only from implantation on the raw wound, and if the muscles are kept close round it, there will be no retraction and no leakage. A mucous tube an inch long kept in close apposition by surrounding muscle or elastic tissues is the best preventive of leakage, in my opinion.

Many elaborate devices not operative have been designed to prevent leakage. Lannelongue's hour-glass-shaped obturator, Huber's trumpet-shaped horn with rubber ring, Mikulicz's glass tube, and v. Langenbeck's rubber air-pillow are amongst the best known of these. None of them are quite successful, and all are troublesome in use. Terrier advises the making of a very small incision, and leaving out the tube, introducing it only at feeding times. Von Hacker makes the fistula through the fibres of the rectus—a suggestion we may well adopt; Girard by crossing the fibres would get the sphincteric action at its best. But if the gastric loop is not kept well fixed in the wound, it will slip away from

* *Amer. Journ. Med. Sc.*, Oct., 1894.

these sphincteric fibres and be dragged inside the abdomen, while we are left with a simple fistulous tract amongst muscular fibres lined with granulations leading to a simple hole in the stomach-wall, which will in all probability permit leakage.

WITZEL'S METHOD OF PERFORMING GASTROSTOMY.*

(FIG. 107).

Witzel's operation seeks to avoid leakage by the provision of a long oblique opening through infolded stomach-wall.

He uses the oblique parietal incision along the costal margin, and separates the fibres of the rectus and transversalis. The

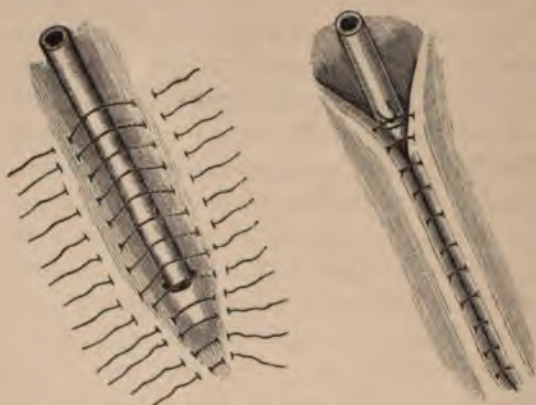


FIG. 107.

Witzel's Method in Gastrostomy.

The figure on the left shows the Tube placed in the small opening in the stomach-wall, and the sutures placed preparatory to tying. The figure on the right shows the sutures tied, the gastric walls infolded and the Tube buried under them.

peritoneum is divided along the line of the incision, and the stomach is drawn out of the wound. A very small incision is made in the stomach-wall and at some distance from the point settled upon for fixation; a small rubber tube is placed in this, and the stomach-

walls infolded over it for some distance and stitched by a double row of Lembert sutures. The peritoneum is now carefully stitched all round this operation area in the stomach, so that the whole field is rendered extra-peritoneal. The rubber tube is gripped by muscle; the stomach is not.

* *Centralbl. f. Chir.*, 1891, xxxii.

So long as this fistula remains long and oblique, so long is it unlikely that there will be leakage. But as Mikulicz, himself an advocate of the method, pointed out, the outer and inner openings will, in course of time, approximate, and there will then be a simple direct sagittal entrance with as much tendency to leakage as after any other method. This is one objection: another and more important objection is the elaborateness of the operation itself, and the prolongation of the time necessary in performing it. In these patients any proceeding that prolongs the operation period is under serious disqualification as compared with any other method which is shorter, and gives results even approximately as good.

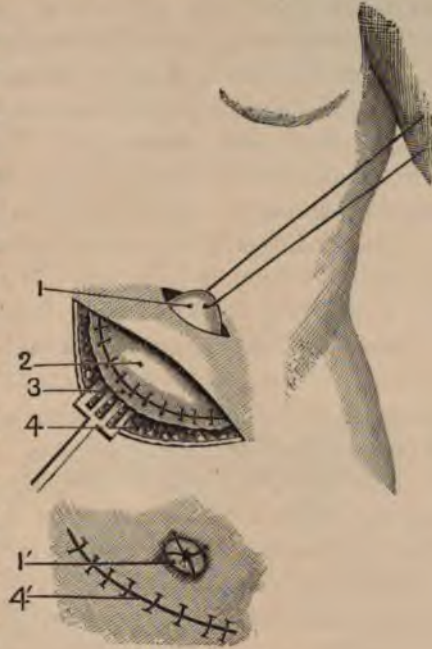


FIG. 108.

Ssabanejew-Frank Method in Gastrostomy.

1. Stomach pulled through incision in skin above parietal incision. 2. Stomach-wall. 3. Parietal peritoneum sutured to stomach-wall. 4. Raw surface of parietal incision held open by retractor. 1'. Gastric opening after conclusion of operation. 4'. Parietal incision closed.

FRANK'S METHOD OF PERFORMING GASTROSTOMY.

(FIG. 108).

This method was introduced quite independently by Ssabanejew* and Frank.† The fortune of the naming has gone (perhaps by euphony) to Frank.

In this operation a cone or loop of stomach-wall is pulled

* *Vratch.*, 1890, No. 39.† *Wien, Klin. Woch.*, 1893, No. 13.

through a small cutaneous incision made at a distance above the parietal incision, and the gastric fistula is made through the tip of this cone.

The ordinary oblique costal incision is made. Muscles are, as far as possible, separated and not divided. A silk loop is attached at the point where the fistula is to be made, and a cone of stomach thereby pulled out. The parietal peritoneum is stitched all around to the base of the gastric cone and also to the divided muscles. A second incision, three-quarters of an inch long, penetrating only skin and subcutaneous tissue, is made above the parietal incision from an inch and a quarter to an inch and a half distant from it. The areolar tissue between the two incisions is undermined, and the cone of stomach pulled through the second incision and fixed to its margins. The parietal wound is completely closed, and the fistula is made at the apex of the loop fixed in the small incision.

This operation, it will be seen, provides a bent fistulous tract into the stomach, and fixation over a considerable raw surface. The objection to it is, that the skin to which the stomach is fixed is mobile, and that the orifice of the fistula may in time be drawn down to a position directly opposite the parietal opening. However, as the muscles are separated and lie closely around the stomach-walls, leakage is not likely to be troublesome.

PAUL'S METHOD OF PERFORMING GASTROSTOMY.*

(FIG. 109.)

Paul of Liverpool has successfully employed his glass drainage-tube in gastrostomy, and speaks highly of the method. The stomach-wall is pulled out of the wound and two running sutures of fairly stout silk are carried round the site where the opening is to be made, with their ends in opposite directions. (A, Fig. 109.) These sutures pick up only the serous and muscular layers and do not perforate the mucosa. The opening

* *Lancet*, 1893, vol. ii., p. 1562.

is then made and its edges grasped with catch-forceps. Through the opening a small-sized ($\frac{3}{8}$ in.) tube is passed, and over the expanded end of the tube the ligatures are drawn tightly and tied. The stomach surface is now washed and returned into the abdomen; the parietal wound is closed, and the ends of the sutures clasping the stomach-opening to the glass tube are tied over two glass rods (Fig. 109, 3) crossing the wound on the skin, and so keeping the stomach in contact with the parietes. The tube is set free by sloughing of the gastric walls where they are encircled by the ligatures.

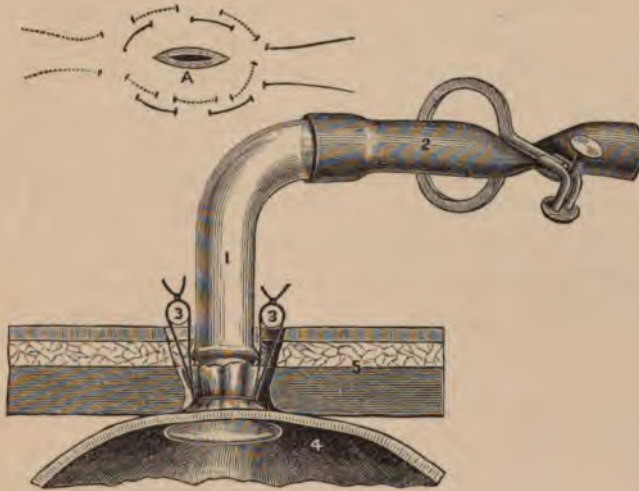


FIG. 109.

Paul's method of performing Gastrostomy.

- A. Method of passing the ligatures in the stomach. 1. Glass tube. 2. Rubber tube with clip.
3 3. Sectional view of glass rods over which the ligatures are tied. 4. Interior of the stomach. 5. Abdominal wall.

Objections to this method, simple and ingenious as it is, are : the essential sloughing and the uncertainty of its extent ; the small area over which contact between stomach and parietes are apposed ; and the leaving of a gastric perforation pure and simple which is continued outwards by a sinus of granulation tissue, which is liable ultimately to permit of leakage.

Many other modifications of the operation have been put forward; these space will not permit me to describe. If the main principles of firm fixation to the parietes, the provision of a tube of stomach-wall to make the fistula, and close coarctation of muscle are observed, almost any method of operation will succeed.

Gastrotomy.

Operation for Removal of Foreign Bodies in Stomach.

History.

Indications for Operation.

Operation Described.

Operation for Removal of Foreign Bodies in Œsophagus.

Operation for Removal of Cancerous Growths in the Stomach.

Gastrotomy (γαστήρ—stomach, and τομή—incision) is here used in the limited sense of meaning the operation of making an incision into the stomach, and more particularly with the view of removing foreign bodies lodged in that viscus. Gastrotomy may have to be performed for other purposes, as for dilatation of the pylorus or the œsophagus, or for the removal of foreign bodies in the gullet; but in these cases the operation is subsidiary. As a synonym for coeliotomy, the word Gastrotomy is in frequent use at the present time; in this sense its employment is confusing.

GASTROTOMY FOR THE REMOVAL OF FOREIGN BODIES IN THE STOMACH.

History.—This is a very old operation. One Crolius is said to have removed a knife from the stomach in 1602, and Guenther is credited with a similar operation in 1613. In 1635 Shoval* successfully removed a knife six inches long, and in the same year Schwaben† had a like success. Considering the early and striking success of gastrotomy, and the undoubted frequency of the necessity for it, it is remarkable that the operation was performed so few times in the following century. Successful cases are reported by Hubner in 1720, by Cayroches in 1829, by Bell in 1860, by Labbe in 1874, and by others.‡ It is perhaps

* Chelius's *Surgery*, vol. ii., p. 391. † Hévin, *Mém. de l'Acad. de Chir. de Par.*

‡ See Poulet, *Foreign Bodies in Surgical Practice*, vol. i., p. 162.

even more remarkable that in the modern era of abdominal surgery the operation should have been so rarely performed. Gross* quotes only twenty cases, three of which were fatal. The more accurate tables of Credé† and Richardson‡ and Bernays,§ which exclude all doubtful or ill-authenticated cases, reduced the number to thirteen or possibly fourteen. All recovered save two, and in these were specially troublesome complications. Some ten or twelve operations have since been recorded, nearly all of them successful. There can be no doubt, therefore, that gastrotomy is not a dangerous operation: under modern rules, it ought not to have a death-rate of more than eight or ten per cent.

Indications for Operation.—The conditions pointing to operation are twofold: (1) the presence of a foreign body in the stomach, of such a nature that we know it cannot be passed through the intestines, or can be passed only at great risk; and (2) the existence of serious and urgent symptoms in the patient.

The great majority of foreign bodies swallowed pass through the pylorus, and are voided in the stools. It is a common statement that anything which passes the cardiac opening will pass the pyloric. And so it will, as far as the smallest diameter of the body is concerned; but where long bodies are swallowed, such as knives, spoons, forks, pencils, bars of lead, or, as in Fournier's case, the hoop of a barrel fifteen inches long, we can scarcely expect that they will be passed through the pylorus and along the duodenum and the numerous coils of small intestine. As a matter of fact, long bodies rarely escape from the stomach at all.

Aggregations of small foreign bodies require removal, as much as long or large single bodies. They may become glued together by mucus, and form a mass whose diameter is considerably greater than that of the pyloric orifice. At least four cases are on record where masses of hair have been successfully

* *Trans. Amer. Surg. Assoc.*, vol. ii. † *Arch. f. klin. Chir.*, XXXIII., iii.

‡ *Boston Med. and Surg. Journ.*, Dec. 16th, 1886.

§ *Phila. Med. News*, Jan. 1st, 1887.

removed from the stomach. The patients were under the care respectively of Thornton,* Schönborn of Königsberg, Berg of Stockholm, and Paul Swain† of Plymouth. In Thornton's case the mass of hair weighed 2 lbs., in Schönborn's 9 or 10 oz., in Berg's about 30 oz., and in Paul Swain's 5 lb. 3 oz.

Mayo Robson‡ records a remarkable case in which he successfully removed from the stomach of a girl aged twelve "forty-two cast-iron garden nails, 1½ in. long; ninety-three brass and tin tacks, from ¼ to 1 in. long; twelve large nails, some brass headed; three collar studs, one safety pin, and one sewing needle." Dr. Gemmel§ removed by gastrotomy from a woman a number of foreign bodies weighing 1 pound 9½ ounces; the patient did not survive the operation.

Apart from the remote risk attending the prolonged presence of a foreign body in the stomach, the subjective condition of the patient may be such as to demand operation. The patient is constantly nauseated; he has an indefinable sensation of distress and anxiety referred to the pit of the stomach; he complains of severe shifting pains in various situations, which are sometimes distracting (in at least one case they drove the sufferer to suicide); and his combined sufferings often render life a prolonged agony. In other cases the symptoms are less urgent, but they are always more or less distressing. Frequently the ingestion of food relieves the pain; sometimes it aggravates it. The patient occasionally finds relief in special postures, and constantly assumes them. The slightest movement may aggravate the pain; the patient may have to tread with slowness and difficulty, and his breathing may be performed superficially or with effort. Soon the health fails; the patient becomes pale, thin and worn; he becomes liable to attacks of syncope, or even convulsions; vomiting sets in, sometimes with bleeding; wasting goes on to an extreme degree, and death takes place in the last stage of exhaustion.

Local conditions demanding operation may exist. These are produced when the foreign bodies show signs of perforating

* *Lancet*, Jan. 9th, 1886. † *Lancet*, June 22nd, 1895.

‡ *Lancet*, 1894, II. § *Lancet*, Aug. 25th, 1894.

the walls of the stomach, either immediately by cutting them through, or gradually by ulceration and the formation of abscess. Richardson* has collected 11 such cases occurring between 1602 and 1882, the foreign body in each case escaping either spontaneously or after a simple incision; and only one of these cases died. Perforation into the peritoneum, if untreated, is certainly fatal. The risks of perforation through the parietes when the stomach becomes adherent to them are evidently not so great, but they are sufficient to demand operation. Perforation in other directions—towards spleen, liver, lung, or heart—must be reckoned among the terminal casualties.

THE OPERATION.

To facilitate operation, various plans of distending the stomach have been suggested. Felizet of Paris† utilised the vapour of ether for this purpose, in an operation for the removal of a spoon. A piece of rubber tubing was passed into the stomach; the outer extremity of the tube was bifurcated—one of the ends communicating with a funnel, the other with an ether reservoir. The stomach was first washed out with a solution of bicarbonate of soda, poured in through the funnel. The ordinary incision was then made; when it was concluded, the ether reservoir was placed in hot water, and the vapour, passing along the tube into the stomach, distended it and forced it through the wound. Felizet, while the stomach was distended, sutured it to the wound before removing a spoon, and a gastric fistula was left. Schönborn,‡ in a case of gastrotomy, made use of a bladder attached to the end of a hollow sound, which he distended by blowing. Jacobi§ and Fowler|| have caused distension by pouring into the stomach measured quantities of acid and bicarbonate of soda. Other methods have been used or recommended.

It is very doubtful if the advantages of distending the

* *Loc. cit.* † *Lancet*, vol. ii., 1882. ‡ *Langenbeck's Archiv.*, xxii., p. 500.

§ *New York Med. Journ.*, 1874, vol. xx., p. 142.

|| *Ann. Anat. and Surg.*, vol. vi., p. 27. Brooklyn, 1882.

stomach counterbalance the disadvantages. The advantages are, increased facility in finding the stomach, and the comparatively small size of the opening made while the walls are stretched. The chief disadvantages are, the trouble to the patient connected with the process of distension, the difficulty in preventing the distending agent from coming into contact with the peritoneum (even ether is not innocuous), and the increased difficulty of finding the foreign body in a distended cavity. Billroth, in one case, found this last difficulty a very troublesome one to overcome. The exigencies of the case would probably be met by a prior cleansing of the stomach with a dilute solution of bicarbonate of soda. There is no objection to the patient's swallowing, just before operation, eight or ten ounces of some innocuous fluid; this amount will be quite sufficient to throw the stomach into prominence, while it is not too large to be collected in sponges should it escape. On the whole, perhaps, it is best to operate upon an empty stomach, which has been previously cleansed by an alkaline solution.

The site of the incision is not of so much importance as in gastrostomy. It may be higher up; if the liver is in the way, it can easily be kept back by a retractor. No advantage is gained by getting close to the ribs; the flexibility of the parietes, which is useful in permitting manipulation and the introduction of sponges, is diminished by proximity to the fixed rib-cartilages. If, as occasionally happens, the foreign body can be felt, the incision through the parietes is best made directly over it. And if signs of perforation show at any part, this also guides to the site of incision. Labbe recommended an incision parallel to the left costal margins, the lower end of which did not descend below the level of the tip of the ninth cartilage. Bell and Neal made use of an incision extending from the umbilicus towards the left false ribs; Vidal de Cassis made his incision in the middle line; and other incisions, too numerous to mention, have been employed.

If the foreign body is very large, as in Thornton's case, the incision is best made in the middle line. The *linea semilunaris* is, for most cases, too far outwards. Labbe's incision is probably

as good as any for those cases where the site of election is not determined by the foreign body being felt. The incision, beginning at the level of the tip of the ninth rib-cartilage, and about an inch and a half to the inner side, is carried upwards parallel to the costal margin for a distance of two and a half or three inches. The muscles are divided or separated and the peritoneum opened in the same way as in gastrostomy.

Now that the competency of sutures in wounds of the hollow viscera to prevent escape of their contents has been abundantly proved, the old practice of fixing the stomach to the parietes need not be followed. The stomach may be opened, sutured, and returned to the abdominal cavity, with an assurance that, if the stitches have been properly placed, there will be no escape of gastric fluids.

When the peritoneal cavity is entered, two fingers are passed over the anterior surface of the stomach, to feel for the foreign body. Occasionally some difficulty in detecting the body is encountered. If, as is usually the case, the body is long, the end which lies most conveniently to the parietal wound is selected as the site of the stomachic incision. If the body is sharp-pointed at one end (as a fork), the blunt end is chosen. Particular care must be taken that the gastric wall is not perforated by rough handling of a sharp-pointed foreign body. If the blunt end lies at considerable distance from the parietal incision, it will be wise policy to open the stomach over the sharp extremity. In the case of collections of hair, the stomach may be opened where it protrudes most. Each case must be judged on its merits as to site of opening.

When the spot for making the opening has been selected, the whole surface of the stomach around this spot is covered with flat sponges. Two silver or silk guiding loops are inserted through the muscular and serous coats at the sides of the proposed line of incision; the stomach is gently pulled to the surface by these loops, the ends of which are now entrusted to an assistant, who keeps the stomach pressed up against the sponges by means of them. The line of incision is best made parallel to the course of the vessels—that is, transversely to the

curvatures, or in a line with the abdominal wound. An opening of sufficient size is made between the loops by knife or scissors, and the forefinger, inserted through it, feels the body and enables the surgeon to decide upon the best mode of extraction. The finger may be able to push the end of the body through the wound, when it may be caught; or it may be lifted out between the forefinger and a lithotomy scoop or similar instrument; or the end may be seized in suitable forceps, whereby it is dragged out of the wound. Sometimes the body is found embedded

in granulations, which bleed freely on being disturbed; the greatest care must then be taken to avoid perforation of the stomach. During the manipulations, the assistant takes care that the sponges are well placed to absorb any escaping fluid.

When the foreign body has been removed, it may be wise, if there is much mucoid or purulent or bloody material in the stomach, to cleanse it by means of small sponges on sponge-holders. The less the stomach is irritated the better, however. Before beginning to place the sutures, a very soft suitably shaped flat sponge is inserted through the wound, with a long piece of

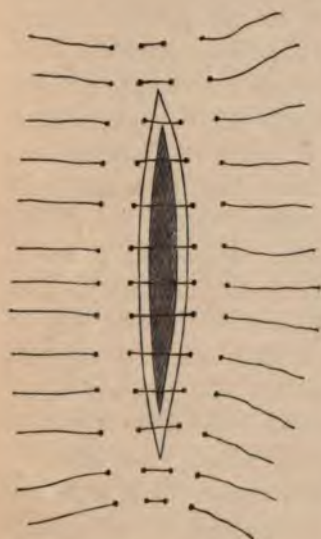


FIG. 110.

Lembert's Suture.

thick silk passed through it to draw it out by when the deep sutures have been inserted and before they are tied.

The best form of suture for the stomach wound is the Lembert (Fig. 110), or some simple modification of it. The best needle is a milliner's needle of medium size; the suture material should be fine Chinese twist. The sutures are most easily and rapidly inserted along folds of the stomach-wall raised by traction on quilt stitches placed about two inches apart, in the

manner described and depicted further on for Enterorrhaphy. The needle passes through the serous, sub-serous, and muscular coats, piercing but not cutting the tissues, and does not enter the mucous coat. The accompanying diagram (Fig. 110) may be taken as representing on natural scale the mode of placing and the closeness of the sutures. When the sutures have been placed, their ends are gathered together in the blades of catch-forceps, the threads crossing the middle of the wound are teased apart, and the sponge is removed. The sutures are then systematically and carefully tied, beginning at one end and going on to the other. A second row of sutures, passing through peritoneum alone, is sometimes placed in alternation with the first row. These sutures are ordinarily interrupted, but very perfect apposition may be got by making them continuous. A double continuous row, where the sutures cross and the free ends are tied together at the end of the wound, may be used if the wound is small. Appolito's suture (see Enterectomy) would seem to be very suitable. Expansion and contraction take place through a wider range in the stomach than in the intestine. The continuous suture prevents stretching of the intervals, and subsequent escape of fluid when the stomach expands; if the stomach contracts, the continuous suture might get loosened. Unless the stomach is quite contracted, which is different from being empty, the interrupted suture is the safer.

When the stomach wound is perfectly closed, the sponges are removed from the abdominal cavity. A dry sponge is finally inserted on a sponge-holder to make sure that no foreign matter is left behind. The parietal wound is then closed in the ordinary way.

The subsequent treatment consists in giving absolute rest to the stomach for three or four days, the patient being fed on enemata meanwhile. Very small quantities of peptonised milk, diluted with water, are given at stated intervals for two or three days more; and then beef peptonoids and thin broths may be added to the diet, while the intervals of feeding may be lengthened and the amount of food increased. At the end of a fortnight, starchy foods may be given; and, at the end of three weeks, ordinary light diet.

If vomiting takes place at any time, all food must be withheld till it has ceased. Separation of the lips of the wound is more likely to take place when the stomach contracts or is compressed over fluid contents, than when it is empty.

GASTROTOMY FOR REMOVAL OF FOREIGN BODIES IN THE
ŒSOPHAGUS.

For foreign bodies impacted near the cardiac extremity of the œsophagus, when all attempts to remove them by the mouth have failed, gastrotomy may be performed with the view of removing them through the stomach.

Maurice H. Richardson of Harvard University, in 1886, introduced the operation by a very successful case. He succeeded, after introducing the whole hand through an opening in the stomach, in removing a denture of teeth impacted in the lower portion of the gullet. Since then he has made careful anatomical observations on the details of the operation, and studied its indications and possibilities.* In a series of cases he found that the average distance from the incisors to the diaphragm was $14\frac{1}{2}$ inches: a foreign body arresting the point of the probang at a distance of 13 inches from the incisors would therefore be near to the cardia, and might be removed by gastrotomy. He found that all parts of the œsophagus were accessible to the finger, either by gastrotomy or external œsophagotomy. It is possible with the fingers of the left hand to reach three inches above the cardiac orifice.

Richardson recommends an oblique incision along the margins of the left ribs long enough to admit of the introduction of the whole hand. The vertical incision he considers best for the introduction of instruments. The stomach is pulled to the surface and carefully isolated with sponges. The lesser curvature is put on the stretch, so as to make a sulcus between the anterior and posterior surfaces, leading straight to the cardiac

* *Lancet*, Oct. 8th, 1887.

opening and serving as a guide for the introduction of instruments. The site of the incision in the stomach is unimportant. It must be far enough to the right to allow of the passage of the instrument along the sulcus, as described. If the instrument is brought obliquely to this groove and passed upwards, all the time being pressed gently against the straightened lesser curvature, it will glide into the œsophagus every time with the greatest ease.

The assistant, standing on the patient's left, holds the stomach by the greater curvature in both hands, so that the whole viscus is flattened out. "The operator, standing on the right of the patient, holds the lesser curvature between the left thumb and forefinger, thereby making tense the lesser curvature, and assisting in the passage of the instrument. Before doing this it is best to introduce the hand into the peritoneal cavity, and examine the diaphragmatic opening externally. With the stomach held as described, the opening through its walls may be made anywhere on the flattened surface, so as to avoid the large vessels." In most cases the foreign body may be removed with a suitable instrument: if this fails, the stomachic incision must be enlarged, and the whole hand introduced. The opening in the stomach is closed by the Lembert suture in the ordinary way.

W. T. Bull of New York,* in recording an operation of this sort successfully performed by him, makes some novel and valuable observations. The patient was a boy of 16, and had swallowed a peach-stone, which was found firmly impacted in the œsophagus, at a distance of 13 inches from the incisors. After ineffectual attempts to dislodge it by the mouth, Bull, through a median vertical incision in the parietes, made a small opening in the stomach just large enough to admit the finger. After passing sponges into the abdominal cavity to collect any fluid that might escape, he placed four loops of thread in the wall of the stomach around the opening, and then, invaginating the anterior wall of the stomach, while the finger plugged the opening, pushed the finger onwards to the end of the œsophagus. The peach-stone was felt, but could not be dislodged by finger or forceps. He then passed a fine bougie from below upwards

* *New York Med. Journ.*, Oct. 29th, 1887.

past the stone into the mouth ; attached a piece of sponge by a strong silk ligature, to the end of the bougie, and pulled it through the mouth. The sponge passed by the foreign body ; but a second and larger sponge, attached to the same string, pulled it into the mouth.

The patient made an excellent recovery. In this case very thin and lax parietes made the operation possible without passing the hand into the abdomen. In most cases it would probably be necessary to pass the hand inside the abdomen ; but it need not always be necessary to make the large opening into the stomach.

It is too early to draw conclusions from these operations. There can be no doubt, however, that they present a valuable means of treating a peculiarly difficult, if uncommon, class of cases.

GASTROTOMY FOR REMOVING CANCEROUS GROWTHS IN THE STOMACH.

Augustus C. Bernays of St. Louis has recently* introduced to the profession a remarkable operation, whereby, after making an incision in the walls of the stomach, he removes, by curette or other suitable instrument, cancerous growths bulging into the stomachic cavity. He records two cases, and the results in each were so strikingly favourable as to warrant the conclusion that the operation he has introduced is worthy of a full trial in the hands of others.

As a result of extended study, he found that "one-half of all cancers of the stomach start near the pylorus, and that in nine-tenths of all cases they have a tendency to grow towards the lumen of the stomach. In the beginning the mucous membrane is the seat of the disease ; the sub-mucous, loose connective tissue is next attacked ; and only in the last stages are the muscular and serous coats invaded by the neoplasm." The muscular layer becomes soon hypertrophied, but it is last

* *Annals of Surgery*, Dec., 1887.

invaded; "cancer of the stomach originally grows inside the muscular layer, towards the lumen of the organ."

Reasoning from these facts, and from the analogy of results got after curetting similar cancers elsewhere, Bernays decided, as an alternative to other impossible or unsatisfactory operations, to give certain selected cases a trial by scraping or curetting. He first made an accurate examination of the parts from the outside of the stomach; then fixed a fold of the stomach to the parietal wound by numerous sutures. He then opened the stomach and carefully stitched the lips of the opening to the lips of the wound in the parietes. The stomachic cavity being thus completely shut off from the abdominal cavity, he proceeded with fingers and curettes to tear and scrape away masses of the growth. The bleeding was free, but soon ceased.

The stomach remaining attached to the parietes, the operation may be repeated without performing cœliotomy when the renewed growth of the tumour calls for it. The gastric fistula may or may not be closed.

For a full account of the operation, and a history of the cases, I must refer the reader to Bernays' paper. As an alternative to such operations as gastro-enterostomy and pylorotomy, where these are impossible, the operation seems to me to have already assumed a justifiable position; and, even in cases where these are possible, it seems likely that Bernays' operation will appear as a worthy competitor.

Gastrorrhaphy.

For Gastric Fistula.

For Dilatation of Stomach.

Gastrorrhaphy (γαστήρ—stomach, and ραφή—suture) is usually employed to signify suture of a wound in the stomach. In its old sense, as meaning suture of a wound in the abdominal parietes, the word may now be considered obsolete. In its literal sense, gastrorrhaphy is part of several other operations in which the stomach walls are incised; these are considered in their separate places. So may it be used to signify closure of a perforating ulcer; this will receive separate consideration. So also will the operation as performed for perforating wounds be separately considered as part of the section on wounds of the abdominal viscera.

Suturing of the stomach has been performed several times for dilatation of the stomach; it will be convenient to describe this operation here. The closing of gastric fistula by operation will also be described here.

GASTRORRAPHY FOR GASTRIC FISTULA.

Gastric fistula is not common; Murchison was able to find records of only twenty-five cases in a period extending over three centuries. Therefore operations for its cure must always be rare. According to Wölfler,* a Bavarian surgeon, in 1521 first performed Gastrorrhaphy. Of modern surgeons, Billroth has, so far as I know, been the only operator for gastric fistula.

Operation would be indicated in a case of gastric fistula, in which the stomachic contents were constantly dribbling away, or in which the food taken by the mouth escaped, and which had resisted all minor means of alleviation or cure. Perforating ulcer of the stomach, the most common non-traumatic cause of gastric

* *Ueber die . . . Resectionen des Carcinomatösen Pylorus.* Wien, 1881.

fistula, may pass through the parietes by direct extension or through an intervening abscess; in the latter case we may expect more inflammatory thickening than in the former, and the operation would thereby be rendered more difficult. The site of the fistula would, however, be the most important consideration. If, as in St. Martin's case, the fistula passes between the ribs, the operation would be complicated. If, as in Maillot's case, it lies close to the ensiform cartilage, the operation would require care and judgment. But if it is well free of the bony parts, it need present no great obstacles to successful performance.

THE OPERATION.

The operation is preceded by a thorough washing-out of the stomach through the fistula with an alkaline solution. Several pieces of sponge, with strings attached, are passed through the fistula into the stomach and pulled outwards by an assistant. They prevent the escape of mucus, steady the organ, and absorb any blood which may be lost during subsequent proceedings. They need not be removed until the first row of sutures has been placed in the gastric wall. The granulations surrounding the fistula are thoroughly removed by a sharp curette or by a scalpel, and the track mopped out with 1-20 carbolic lotion. This is done to prevent any risk of contamination of the peritoneum when the cavity is laid open.

The parietal incision, about three inches in length, passes through the fistulous opening, and is made in any direction that seems to be most convenient. The peritoneum is divided and the cavity entered at one extremity of the wound, so as to get beyond the adhesions which fix the stomach to the parietes. Under the guidance of the finger, the peritoneum and any attached adhesions are divided through the whole length of the wound. The surrounding adhesions are then separated with finger and finger-nail, and the stomach-wall is completely detached. By means of traction on the strings attached to the sponges inside the stomach, with, if necessary, the aid of catch-forceps fixed on the edges of the fistula, the freed stomach-wall is pulled through

the parietal incision. The operation area is now isolated by means of flat sponges or sponge-cloths packed around the edges of the parietal opening. In most cases it will be wise to freshen the edges of the fistula with scissors or knife, and perhaps to shave off any redundant thickened or inflammatory tissue surrounding it.

The fistula is closed in the same manner as the wound in gastrotomy (p. 499) by Lembert sutures of silk, in one or two superimposed layers. The suturing should go about an inch beyond the fistula on both sides, so as to provide sufficient infolding and give a broad union of surface. The peritoneum will usually be much thickened and very friable, so that a deep hold and moderately thick sutures will be advisable.

The cleansing of the stomach and all the subsequent step and after-treatment are the same as in gastrotomy, and need not again be described. The fistulous track in the parietes should be freely excised, and the margins of the wound trimmed so as to give exact apposition in its whole length.

GASTRORRAPHY FOR DILATED STOMACH.

For dilatation of the stomach, Bircher, a Swiss surgeon, has performed this operation three times, and Weir of New York* once. Bircher's operations were done for simple dilatation. Weir's was performed on a patient who, two years previously, had undergone the operation of gastro-enterostomy for pyloric stenosis, but in whom relief was only partial and temporary.

In cases where gastric distension has been so prolonged and so extreme that the stomach remains a flaccid inert bag, incapable of contracting and serving only as a receptacle in which decomposition may take place, the operation may have a certain justifiability. But all other measures ought first to have been exhausted before this one is resorted to.

Weir thus describes the operation which he performed: "The end of the operation I proposed was, to attach the greater curvature along the portion of the stomach to the left of the gastro-enteric opening. This was done in the following

manner: In the centre of the space between the upper and lower borders of the stomach a dimpling in of the gastric wall was made first by pressure of a sound to a distance, say, of an inch. A row of 8 or 10 interrupted silk sutures was now made, passing through the serous and muscular coats for a distance of from 6 to 8 inches, and the sound withdrawn. A second series of sutures, at about an inch from the first, was again made, dimpling in an additional portion of the stomach-wall and in a similar manner. A third and fourth row of interrupted silk sutures were applied until through a distance of some 4 to 5 inches the greater curvature was applied to the lesser curvature. When this was completed, a double fold of the stomach, estimated equal to the breadth of the hand and nearly its length, had been made in such a way that this projected into the cavity of the stomach.*

The value of the operation has yet to be proved. Perhaps a less elaborate suturing might suffice; and infolding over wider areas, with less superimposition of parts.

* *New York Med. Journ.*, 1892, ii., p. 29.

Operations for Stricture at the Orifices of the Stomach.

Pyloric Dilatation. Pylorodiosis.

Pyloroplasty.

Retrograde Œsophageal Dilatation.

These operations are employed for the cure of non-malignant stricture at the pyloric and the œsophageal apertures of the stomach. The operations are performed through an incision made in the stomach-wall. In pyloroplasty, this incision is employed in the operative cure; in divulsion of the pylorus and œsophagus, the gastric incision is intended simply to provide access to the seat of operation.

The Aim of the Operations.—The operations are intended only for strictures of non-malignant character. In the lower end of the œsophagus these strictures are usually of a cicatricial character, and result from the swallowing of some corrosive fluid; but cases of non-malignant stricture without any such history are met with. At the pylorus the stricture may be cicatricial, when it would probably be caused by ulceration; or it may be caused by great hypertrophy of muscle; or it may arise from a combination of fibrous and muscular hypertrophy. The pathology of these strictures is very imperfectly understood; no completely satisfactory description of their origin has yet been provided. Their association with chronic gastritis and vomiting suggests a double or reactional causation—inflammatory and hypertrophic from disease and over-action of muscle, the constriction of the pylorus causing distension and vomiting; and the vomiting causing hypertrophy of the pyloric muscle and narrowing of the lumen of the gut.

Operative treatment of non-malignant stenosis was introduced by the late Professor Loreta of Bologna, in 1882; he employed divulsion or over-distension of the constricted orifice. He justly compares his operation with that of over-distension of fibrous

stricture of the rectum, which is well known to be highly successful. There can be no dispute in practice that sudden divulsion of a fibro-muscular stricture usually results in cure so far as the intestines are concerned. The cicatricial stenosis in urethral stricture is not quite analogous, but even here the almost universal testimony of surgeons is that there is little to choose as regards permanence of result between divulsion and incision. In the case of the more muscular strictures of the gastric orifices divulsion is at its best, and here the results are surprisingly good. For stricture in the lower œsophagus divulsion is the only plan available; for stricture at the pylorus a plastic cutting operation has come into use which has very properly got many adherents. Personally, I do not think that divulsion of the pylorus can be given up. Cases of extreme stenosis with enormous muscular hypertrophy would probably be treated best by divulsion, for in such it would be very difficult so to bend the hypertrophied tissue as to get safe closure at the angles of the wound. The operation of choice should be pyloroplasty; but it should not be forgotten, if this operation promises to be difficult or unsatisfactory in a given case, that divulsion has given almost as good results. And pyloroplasty is most satisfactory in those cases where divulsion is least satisfactory; that is, where there is much stenosis but little hypertrophy.

Pyloric Stenosis. Diagnosis.—In pyloric obstruction the patient is greatly emaciated, but the symptoms will have lasted so long as to exclude cancer. The stomach is much dilated, and the diagnosis is then between dilatation "due to pyloric obstruction and that due to idiopathic gastritis." In forming the diagnosis, Prof. Loreta places most value on the chemical and microscopical examination of the contents of the stomach. When positive results are got from the examination of matters rejected or extracted, we may conclude that the dilatation of the stomach is idiopathic; when the results are negative, we may infer dilatation from mechanical obstruction. In mechanical dilatation the gastric contents give an acid reaction, and no traces of albumen

or peptones are found. In the other forms of dilatation the reaction is usually neutral or alkaline, rarely acid, and the albuminoid substances are found unchanged or nearly so. Other and more elaborate instructions for making a diagnosis are given by Prof. Loreta.* Speaking generally, a greatly dilated stomach; vomiting, without nausea and with slight effort, of great quantities of fluid; obstinate constipation over which purgatives have no effect, and a history of gastric ulcer, may be taken as indicating pyloric obstruction.

Simple Stricture of the Lower Œsophagus. Diagnosis.—The diagnosis rests ultimately on the passage of the œsophageal bougie. The amount of stenosis and its position are made out by the size of the bougie and its length as measured from the teeth. In most cases there will be a history of the swallowing of caustic fluid; in all there will be an absence of the signs of cancer; and the ordinary signs, subjective and objective, of œsophageal obstruction will be present. In this case it is presumed that attempts to dilate the stricture by the mouth have failed, and that the so-called “tubation of the gullet” is either impracticable or devoid of result.

Pylorodiosis. Operative Dilatation of the Pylorus. Loreta's Operation.

Pylorodiosis (*δίωσις*—divulsion) may conveniently be used as a name for this operation of divulsion or operative dilatation of a stenosed pyloric opening.

History.—Professor Loreta of Bologna introduced this operation; though Richter of Breslau first suggested it.† In September, 1882, Loreta performed his first operation,‡ a notice of which was first supplied to British readers by Mr. Holmes.§

* *Brit. Med. Journ.*, 1885, i., p. 373. † *Deutsche med. Woch.*, 1882, p. 381.

‡ *Memoire dell' Accademia delle Scienze Istituto di Bologna*, ser. iv., vol. iv.

§ *Brit. Med. Journ.*, Feb. 21st, 1885.

Up to his death he had operated about thirty times. A few other surgeons, chiefly Italian, have performed the operation. McBurney of New York has operated twice. Barton of Philadelphia* has operated twice. Treves of London has operated once. In a case with advanced cancer of the stomach for which gastro-enterostomy was contemplated, I found great contraction of the pylorus, which I dilated through an opening made in the stomach, the patient recovering well and being benefited. I have since operated three times—twice with success, once with fatal result. Barton† has collected twenty-five published operations, and has heard of about eighteen more. The general mortality would seem to be about 40 per cent.: performed sufficiently early and with proper skill, the operation should not have a mortality of over 10 per cent. The cases are too few, and the operations are too recent, for formulating any conclusion as to the permanent value of the proceeding. So far, the results have been most gratifying.

THE OPERATION.

For operating on the pylorus, Loreta at first made his parietal incision, about five inches in length, "on the right of the median line, the upper and inner end being about four centimetres below the xiphoid cartilage, the lower and outer end three centimetres from the cartilage of the ninth rib." He afterwards made the incision in the linea alba. The muscles and peritoneum are divided in the ordinary manner. The pylorus is felt for, and will be found thickened and hardened, and perhaps adherent to surrounding organs. The coats of the stomach, lifted out of the wound as far as necessary, are then pinched up into a fold, and divided by scissors midway between the two curvatures about an inch from the pylorus, or more if necessary. Any bleeding is stopped by *forci-pressure*. (Loreta says nothing of placing sponges around the site of incision in the stomach, to protect the bowels and collect extravasated blood or gastric fluids.)

* *Med. and Surg. Rep.*, Phila., April 13th, 1889, and *N.Y. Med. Rec.*, May 25th, 1889.

† *N.Y. Med. Rec.*, May 25th, 1889.

The right forefinger, introduced through the opening in the stomach, is pushed into the pyloric opening, while the left forefinger steadies it. Considerable force and great patience may be required to overcome the powerful grip of the narrowed orifice. When the finger is passed through the opening, the pylorus may be hooked downwards towards the abdominal wound, and then the left forefinger is also insinuated through the stricture. Even with the fingers thus opposed, the resistance offered to dilatation may appear almost insuperable. After a time the muscle yields, and the dilatation is continued till a sensation is felt as if further distension would result in tearing. The fingers are kept in the opening thus dilated for a few minutes. In Loreta's first case the fingers were more than three inches apart as they lay in the opening.

The wound in the stomach is then sewn up, the organ is returned to its place, and the abdominal incision is closed. The after-treatment is that of gastrotomy.

The subsequent steps of closure of the wounds in the stomach and parietes, and the after-treatment, require no description. It is curious that, in two cases operated upon, there appeared on the fourth day serious disturbances of the circulation and respiration, with abundant secretion of mucus from the trachea and bronchi; and these symptoms, in both cases, lasted over five days. This condition Loreta is inclined to attribute to an exudative hyperæmic process.

It is somewhat surprising that so few surgeons have adopted Loreta's operation. Forcible dilatation of the œsophagus by the mouth has not been attended with much success, and this may have deterred surgeons from imitating Loreta's proceeding through an incision in the stomach. But this objection does not hold with respect to pyloric dilatation. It is certain that many cases diagnosed during life as pyloric cancer turn out, post-mortem, to be nothing more than pyloric obstruction, mainly produced by enormous hypertrophy of the muscular tissue. In the last few years I have seen at least four such cases; and the facts were specially impressed upon me, because

I had spent much time in examining with the microscope for the cancer which was supposed to be present, and found nothing but unstriped muscle. Such cases ought to be diagnosed; and if diagnosed, they are susceptible of great improvement, if not of permanent cure, by Loreta's operation. Pylorotomy has been performed for at least one case of cicatricial contraction: in the face of the proved success of forcible dilation, removal of the pylorus would seem to be doing too much.

Pyloroplasty.

This is the name given to operative enlargement of a stenosed pyloric orifice of the stomach.

History.—The operation was independently conceived by two surgeons: Heineke, who operated in 1886, and Mikulicz, who operated in the beginning of 1887. Gould, who published an operation on May 20, 1893,* collected 22 other operations up to that date. Up to February 16, 1893, 53 operations† had been reported, with 6 deaths. This is rather a high mortality considering that the operations were performed almost entirely by highly skilled and experienced surgeons. No doubt the usually enfeebled condition of the patient is chiefly responsible for the mortality.

THE OPERATION.

The operation is of the simplest possible character. A longitudinal incision is made along the constricted pylorus, this is opened up and united transversely. (Fig. 111.)

The stomach should be empty, but in my opinion no special measures need be taken to wash it out or "purify" it. A little fluid in the stomach is harmless—it rests in the cardiac end; and to wash out the stomach, at best a measure of doubtful utility, may cause distress to an already sufficiently enfeebled patient.

* *Lancet*, May 20, 1893.

† *Lancet*, Leaderette.

The incision may be made in the linea alba between the sternum and umbilicus, and should be from two to four inches in length, according to the depth of the cavity and the tenuity or density of the parietes. The pylorus is caught up between the finger and thumb, and brought into the incision. Adhesions may be found requiring separation. If the pylorus is not movable, slow, firm traction will stretch the binding attachments and permit its being brought to the surface. Suitable flat sponges are placed under it in the wound, and packed in so as to keep the organ to the front and to catch any fluid or blood that may escape.

The first incision is made through the middle of the anterior wall of the stomach close to the pylorus, and is large enough to admit the forefinger. Through the incision the forefinger or little finger is inserted and passed into the pyloric opening, to make

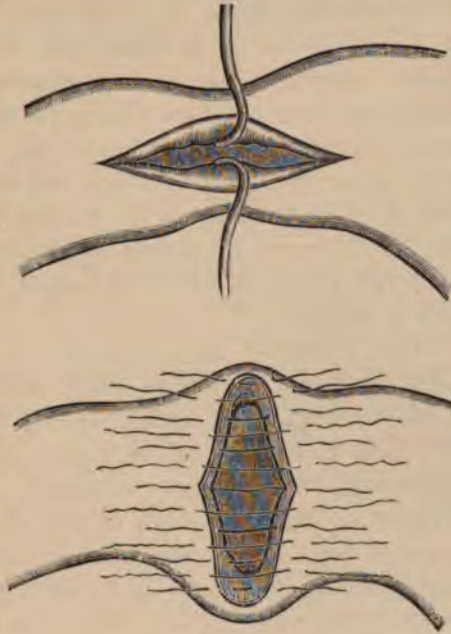


FIG. 111.

Diagrams of Pyloroplasty.

In the upper figure the incision is made and the retractors are in place. In the lower figure the wound is opened up and the sutures placed ready for tying.

sure of the diagnosis and estimate the degree of contraction. The finger is removed and the incision carried right through the stenosed portion into the duodenum. The first part of the incision may be made with scissors or knife; the lengthening of this is best done by one cut with scissors carried through all the layers.

Two blunt hooks (Fig. 111) are now placed in the middle of

the wound, and by pulling them apart the wound is made to gape widely, and ultimately to be changed in direction from being in the line of the bowel to being transverse. If there is much thickening of tissues, the new angles of the wound may require some force to bend them into position. The wound may be pulled open by sutures instead of steel retractors.

The wound is closed by a double row of silk sutures. If the muscular tissue is much hypertrophied, I would advise its being slit so as to make two flaps: the inner flap of mucous membrane and a little muscle may be united by a continuous suture of cat-gut; the outer flap of muscle and serous membrane by an interrupted row of silk sutures. If there is not much hypertrophy, flap-splitting need not be adopted; and if there is no hypertrophy at all, a single row of Lembert sutures supplemented by a continuous Dupuytren suture would suffice. The surgeon must use his own educated judgment as to the best mode of suture.

Mayo Robson* has employed with excellent effect his decalcified bone-bobbin over which suture is made. Rushton Parker† records a successful case by this method. With it, continuous sutures, one for the mucosa and one for the muscular and peritoneal coats, may be employed. The use of the bobbin or similar cylinder I consider to be a distinct advantage in this operation, both as preventing contraction during healing, and as keeping the opening patulous for feeding.

The patient is fed by the rectum for two or three days, and on the third or fourth day feeding by the mouth with carefully selected or peptonised foods is begun.

Retro-dilatation of the Lower Œsophagus.

History.—For the dilatation of fibrous stricture of the œsophagus in cases where a bougie could not be passed by the mouth, Loreta of Bologna introduced the method of attacking

* *Brit. Med. Journ.*, July 20th, 1895. † *Ibid.*, Dec. 14th, 1895.

it from below through an incision in the stomach. The operation has been very successful, no case of some 22 operations having proved fatal, and all having resulted in more or less perfect cure of the stricture.

Kendal Franks of Dublin* was the first to perform the operation in these islands, and the record of his operation is accompanied by a tabulated list of all other operations, and by a clear and precise account of the steps of the operation in general. Maunsell Moullin† has followed with another British success.

THE OPERATION.

The operation may be done in one or in two stages: that is to say, dilatation may be at once carried out through the incision made in the stomach, and this incision immediately closed; or dilatation may be carried out through a gastric fistula kept open for any desired length of time. A third method might be employed—namely, to dilate at once through a gastric incision, and then, instead of immediate closure of the gastric wound, to fix it in the parietal incision so as to form a fistula. This third method might be employed where the dilatation was considered not quite satisfactory and where it seemed advisable to provide for subsequent passage of dilators from below.

The operation in one stage would naturally be preferred for several reasons. Firstly, it is but one operation, performed at one sitting and during anæsthesia; secondly, it admits of introduction of the finger, whereby the stricture may sometimes be felt, and the introduction of the dilating instruments may be guided; and thirdly, it does not involve the discomfort of a gastric fistula. If the death-rate were increased by the one-stage operation, the two-stage one would have a stronger claim; as it is, both are equally successful. The two-stage operation, therefore, ought to be one of necessity and not of choice. That is to say, the next best method would probably be the third, where effective complete dilatation after insertion of the finger is found to be

* *Annals of Surgery*, xix., 1894. † *Lancet*, December 15, 1894.

impossible and it is deemed wise to leave a fistula for further manipulations.

As Kendal Franks points out,* "there is, however, one class of cases in which Loreta's method (in one stage) would not be admissible, and in which the establishment of a gastric fistula becomes a matter of necessity. In cases of extensive injury to the œsophagus, caused by swallowing a strong corrosive, such as sulphuric acid or caustic potash, where the greater portion of the whole length of the œsophagus is in a strictured condition, it would be manifestly impossible to employ immediate dilatation for its relief. A prolonged system of gradual dilatation with bougies can then alone be relied on, and this can be carried out more easily and more surely from below than from above. In such cases the operation *à deux temps* has an established and unassailable position in surgery."

Even here, however, the advantage of making the first dilatation under the guidance of the finger might induce the surgeon to make a primary gastric incision and after partial dilatation, to fix the opening to the parietal incision. This can now be done easily enough, and without appreciable addition to the risk.

The *instruments* necessary are the ordinary ones for coeliotomy, and in addition special instruments for making dilatation. The dilator which Loreta used is made "something like that which Dupuytren introduced for lithotomy, only longer, measuring about eight inches from the joint to the end of the blades, and so constructed that the blades would not separate more than five centimetres." When the instrument is introduced the blades are dilated to the full extent; thus dilated, the instrument is run up and down the œsophagus several times. Kendal Franks used successfully an Otis dilating urethrotome from which the knife had been removed. Other instruments used have been ordinary long forceps, laryngeal or œsophageal, dilatation being made by separating the blades; a uterine dilator; conical and olive-pointed bougies, pushed up from below, and pulled from above

* *Loc. cit.*

by a string; and a plug of gauze or lint which may be pulled upwards and downwards by strings carried through the mouth and the gastric opening. An abundant supply of large flat sponges for packing around the operation area must be in readiness.

The *incision*, to get the closest possible approximation to the cardiac orifice, should be as high up as possible and in the middle line. As the hand may have to be introduced into the abdomen (not necessarily into the stomach), the incision should be of a good length. That made by Kendal Franks in the middle line, five inches in length, and starting from the ensiform cartilage, is probably the best. Such an incision will expose the left lobe of the liver in its upper part, and in its lower part the anterior surface of the stomach or its lower border and the gastro-colic omentum; or the transverse colon, or this and the great omentum. Most commonly the transverse colon and omentum present in the lower wound. These are pulled down until the stomach is brought into view. A fold is pinched up between the fingers, pulled through the incision, and two retaining Halsted sutures are inserted into the extremities of the fold an inch apart. These control and fix the seat of the incision, and may be subsequently used in closing the wound. The cavity around being thoroughly protected by sponges, an incision is made by knife or scissors through all the coats. The stomach is now emptied through a large tube and washed out with a saline or boric solution. If the stomach is empty this step may be omitted. The right forefinger is now pushed through the gastric opening and pushed upward toward the œsophageal orifice. To reach it, the hand will probably have to be passed into the abdomen, the gastric opening being carried up by the forefinger. The œsophageal opening is explored as far up as possible by the finger, and the nature and position of the stricture made out.

The dilator is introduced with or without the guiding help of the forefinger, and the blades separated to any desired extent. A bougie passed by the mouth will show whether dilatation has been carried to a sufficient extent, and will serve as a guide for

pulling up a plug of gauze or any body intended to further increase the size of the strictured lumen. Kendal Franks describes these steps of his operation as follows: "I drew the extremity of the bougie out through the abdominal wound and bored a hole through it. Through this hole I passed a stout piece of silk and knotted it firmly. I then withdrew the bougie back along the same road it had already traversed, carrying the silk with it. I now had a strong silk thread passing from the mouth through the œsophagus, the stomach, and out through the abdominal wound. A plug of gauze was now made about the size of the finger. To one end of this the lower end of the silk was fastened securely. I then fastened another piece of silk to the other end of the plug, and by means of these silk threads I was able to draw the plug upward and downward through the stricture, which it traversed with comparative ease. Finally, I allowed the plug to remain in the stricture, and then I cut short the lower end in the stomach, leaving the upper line of silk hanging from the mouth." This plug was withdrawn the same evening.

The incision in the stomach is closed in the usual way; the isolating sponges are removed, and the operation field gone over with clean sponges. The parietal wound is closed by single or multiple rows of sutures, as is deemed best.

If it is desired to make a gastric fistula, this may be done by one of the methods in use for gastrostomy (*q. v.*) or by closing the gastric incision and passing two resting and fixing pieces of aluminium wire through the muscular and serous coats by the side of the closed incision and so keeping the stomach forward through the parietal wound. It is opened a few days later for passage of the bougies.

Different operators have employed different varieties of method. Thus Hagenbach after performing gastrostomy got a guiding string into the stomach by attaching it to a round shot which the patient swallowed in water. Abbe divided the stricture by sawing it through with a string carried through the mouth and stomach. Lange employed multiple division by means of an ingenious arrangement of small blades devised by himself.

Pylorotomy. Partial Gastrectomy.

History.

Conditions for which the Operation is Performed.

Mortality and Appreciation.

The Operation.

Parietal Incision.

Isolation of the Pylorus.

Resection of Diseased Structures.

Joining the Intestine to the Stomach.

By Sutures.

By Absorbable Rings or Bobbins.

By Murphy Button.

By Gastro-enterostomy.

After-treatment.

By Pylorotomy is meant removal of the pylorus and so much of the duodenum and stomach as may be involved in the disease for which the operation is performed. The operation may thus be a partial Enterectomy as well as a partial Gastrectomy.

History.—According to Blum,* Merrein, in 1810, first conceived the idea of removing the pylorus. A little later Gunther practised the operation on dogs. Gussenbauer and v. Winiwater,† in 1876, demonstrated by experiments on animals that gastrectomy was a feasible operation. Kaiser, at Czerny's instigation,‡ repeated these operations with success; and Wehr§ further continued the experiments.

Péan,|| in 1879, first performed the operation on a human being, but without success. Rydygier, in 1880, performed the second operation, also unsuccessfully. Billroth, who performed

* *Arch. Gen. de Méd.*, vol. cl., 1882, p. 332.

† *Langenbeck's Archiv.*, bd. xix., p. 347.

‡ *Beitragen zur Operativen Chirurgie.* Stuttgart, 1876.

§ *Zeitschr. f. Chir.*, 1882, p. 93.

|| *Gaz. des hôp.*, No. 60, 1879.

his first operation on Jan. 25th, 1881, was the chief exponent of the operation; and, through the writings of his assistant Wölfler, has been chiefly instrumental in bringing it before the profession.*

Conditions for which the Operation may be Performed.—Thus far the operation has been performed almost entirely for cancer of the pylorus. It has several times been performed for ulcer of the stomach in the pyloric region, and once successfully for cicatricial stenosis. Billroth, Czerny, and others strongly advocate it for non-malignant forms of pyloric obstruction, ulcerative or cicatricial, whether originating pathologically or after traumatism, as from swallowing corrosive liquids. Fenwick relates a case of cicatricial stenosis after injury, which might come under this category.

For non-malignant forms of pyloric obstruction most surgeons would probably prefer Pylorodiosis or Pyloroplasty. And for ulcer, unless it lies in the pylorus, a very limited gastrectomy might be considered more advisable. Still, if under any circumstances the operation is justifiable, it will continue to be so for certain cases of non-malignant stenosis or obstruction.

Certain cases of pyloric obstruction are produced by strong peritoneal adhesions compressing the bowel from the outside. These are peculiarly suitable for operative interference—not, however, by pyloric resection, but by dividing the adhesions. I have had good results from two such operations; one of them being combined with Pylorodiosis. Obstruction caused by pressure from a tumour outside is remediable or not, according as the tumour is removable or not.

Cancer of the pylorus remains as the leading indication for pylorectomy. The majority of cases of cancer of the stomach are situated at or near the pylorus: according to Gussenbauer and v. Winiwater, of 903 cases of gastric cancer, 542 were pyloric. In a surgical sense it is important to note that after death in 223 of these cases there were found no peritoneal deposits, and in 172 there were no adhesions. Rokitsky has observed that cancer of the pylorus scarcely ever extends into

* *Ueber die von Herrn Professor Billroth Ausgeführten Resectionen des Carcinomatösen Pylorus.* Vienna, 1881.

the duodenum.* There is always considerable hypertrophy of the muscular tissue surrounding the diseased area, and the obstruction may be due as much to the inability of this mass to contract as to the ingrowth of the tumour.

In making the physical *diagnosis*, it is recommended that the patient be anæsthetised. Special attention is paid to the range of mobility of the tumour, to its size, and to the nature of its surface—whether it is smooth or nodulated. If the tumour is freely movable, we may infer, with a high degree of probability, that there is no invasion of neighbouring organs. In one case the tumour was freely movable, yet the adhesions were so strong and so numerous that the operation had to be abandoned. On the other hand, fixation does not so certainly indicate extension of the disease. Mobility is an effect of dilatation of the stomach; if extensive dilatation does not exist, the pylorus may not have been disturbed from its natural situation. A greatly dilated stomach, with fixation of the pylorus in an abnormal situation, strongly suggests extension of the disease: if irregularity of the surface of the growth co-exists with these conditions, we may certainly infer that the disease has spread, and then operation is out of the question. Free mobility has been found associated with invasion of lymphatic glands; this can be discovered only after proceeding to operate.

There must be present unequivocal symptoms of pyloric obstruction. Dilatation of the stomach will usually be the most important symptom. If there is any doubt as to this condition, it will be advisable to verify it by the generation of carbonic acid gas in the stomach by drinking two solutions one after the other, which when mixed will evolve the gas. The history is important. From other species of pyloric obstruction, cancer differs in producing local pain and impairment of appetite. In cases not cancerous pain is not a prominent symptom, and the appetite may be increased, often to voracity. More than one observer has noted that, in cases of cancer of the stomach, hydrochloric acid is not found in the gastric juice. This test, in my experience, is absolutely without value.

* Billroth's *Clinical Surgery*, New Syd. Soc., p. 494.

Mortality and Appreciation.—The operation is a very fatal one. Mikulicz of Cracow* collected 32 cases, of which only 8 recovered from the effects of the operation. Up to the end of 1887 Billroth† is reported to have operated 18 times, saving 8 patients for a longer or shorter time. One had lived five years. Winslow‡ has tabulated records of 61 cases, which he believes to be all the operations performed up to date of writing. Of these, 16 recovered and 44 died; in one case the result was unknown. A fatal case of my own in which gastro-enterostomy also was performed should be added, as also a successful case done with the use of a decalcified bone tube. Collapse was the chief cause of death, claiming 27 of all the cases. Peritonitis, pure and simple, is not a frequent termination—a fact which speaks volumes for the technical skill of the operators. Four of Winslow's cases died of gangrene of the colon, and a fifth case has since been recorded.§ In a large, and as yet not fully reported, number of cases recurrence takes place a few months after operation. No case, according to Winslow, has lived longer than three years without signs of recurrence. Six cases of Pylorectomy for non-carcinomatous stricture have been recorded, with three recoveries. In these, of course, recurrence is not to be expected.

The most recent statistics are at once contradictory and unpromising. Mc Ardle|| has collected records of 70 operations—8 for simple stricture, 62 for cancer. Of the former, 5 recovered and 3 died; of the latter, 21 died directly from the operation, 14 from peritonitis or septic absorption; “the remaining 27 made good recoveries, many of them being reported well four years after operation.” It is a pity that, in this report, fuller details of the cases were not given; for then it might have been possible to explain the remarkable discrepancy with Butlin's painstaking studies,¶ which seem to demonstrate that, thus far, not one case of those which recovered from operation can be claimed to have

* *Wiener med. Woch.*, Nos. 23 and 24. † *Obstet. Gaz.*, Cincin., Oct., 1887.

‡ *Amer. Journ. of Med. Sc.*, April, 1885.

§ Lauenstein, *Centralbl. für Chirurgie*, 1882, No. 9; March 28th, 1885; and Feb. 21st, 1885. Also, Rydygier, *Ibid.*, March 28th, 1885.

|| *Dublin Journ. Med. Sc.*, June, 1887. ¶ *Operat. Surg. of Malig. Dis.*, page 221.

been really cured of the disease. Schramm* collected 130 cases of resection of the pylorus done in the preceding five years. The mortality varied according to the amount of adhesion present; being 50 per cent. when there were no adhesions, 60 per cent. when there were slight adhesions, and 97 per cent. when the adhesions were numerous.

With these results before us, we must admit that if pylorotomy is to be considered anything more than a mere "surgical exercise," it is to be contemplated only in a very carefully selected class of cases. If the patient is not in fairly good condition, if the stomach is greatly dilated, if the growth is large, fixed, and displaced, the operation ought not to be contemplated. And, even when the obverse conditions are present, it is doubtful if it could ever be a surgeon's duty to advise the operation; he ought to undertake it only at the patient's urgent request, and after fully and honestly explaining to him the hazardous risk which he undergoes.

THE OPERATION.

Before operation, the stomach may be thoroughly cleansed by irrigation through a stomach-tube. If there is fermentation of the gastric contents, an antiseptic such as boro-glyceride should be used in the solution. A final cleansing should be carried out not more than two hours before operation; and the whole of the fluid should be removed, so as to have the stomach empty at the operation. It is unwise to operate if the stomach is greatly distended, for an over-dilated stomach must be badly nourished and intolerant of operative interference. The amount of distension may be readily ascertained by percussion after a seidlitz powder has been administered in separate draughts—one draught containing the acid and the other the alkali.

The operation may be described in successive stages: the incision in the parietes; the isolation of the pylorus; its resection; and the closing of the wound in the stomach, and the uniting of the intestine to it.

* *Wien. Med. Presse*, Nov. 20th, 1892.

The Parietal Incision.—Various lines of incision have been recommended. Péan and Rydygier used vertical incisions—the former in the middle line, the latter a little to the right of it. Others have employed incisions more or less oblique, or almost transverse. Billroth and Wölfler made their incisions almost transverse, and most other surgeons have followed their example. It is true that the greatest space for manipulation will be secured by an opening made in the line of the long axis of the stomach; but such an incision must greatly weaken the abdominal walls. In the cases on which I have operated, a sufficiency of room was got by a simple median vertical incision about three inches in length between the umbilicus and the ensiform cartilage. If the pylorus has sunk low down in the abdomen, Wölfler recommends that it should be elevated before the incision is made. This would undoubtedly give the full benefit to the operator of the relaxation of parts which permits of the descent of the organ.

The first incision, made either over the pylorus in the line of the long axis of the stomach, or in the median line, need be no more than two inches in length. Through this small opening the pylorus is thoroughly explored, and a decision is come to as to the possibility of removing it, and the best course in which to prolong the incision to accomplish removal. Before prolonging the incision (best done with scissors), a sponge is placed inside the abdomen to collect any blood that may escape. The bleeding may be somewhat free, but it is easily controlled by forci-pressure. The whole length of the incision will be from three to five inches. There is no great objection to making a second incision at right angles to the first, if the subsequent steps of the operation will thereby be facilitated.

Isolation of the Pylorus.—The stomach is lifted up to the wound, and the growth carefully examined, to determine the amount of tissue which has to be removed. The great omentum is first divided close to the greater curvature, and over as little area as is possible consistently with complete removal of the growth. The omentum is caught up in successive portions between pairs of pressure forceps, and divided between them. Ligatures are

applied behind the forceps attached to the omentum, and the forceps are removed. Morris suggests that "double ligatures may be passed with an aneurism needle at short intervals through the portions of the omentum to be divided, and the section made after the ligatures are tightened." The same proceeding is carried out with the lesser omentum. Any enlarged lymphatic gland may now be removed. If the pylorus is low down and adherent, the danger of wounding the transverse meso-colon, and so causing gangrene of the bowel, must be

borne in mind. To avoid this risk, Lauenstein has made a suggestion to peel the peritoneum off the posterior surface of the pylorus; but this is scarcely advisable in malignant disease.

When the portion to be removed has been freed from its connections, one or more large flat sponges are placed under it, so as to raise it up through the parietal opening. Other sponges are packed around, covering and protecting every portion of exposed peritoneum, and so rendering the operation as nearly extra-peritoneal as may be.

Clamps may or may not be used. Their employment gives more space for the surgeon to work in, and they are more certain than assistant's fingers in preventing escape of intestinal or gastric contents. A clamp on the duodenum is, I think, always advisable. On the stomach its employment is of doubtful value if there is much distension. But each case must be decided



FIG. 112.

*Intestinal and Gastric Clamp.
Lane's, Modified by Author.
Full-size.*

on its merits. If a clamp is used, the best, in my opinion, is that of Arbuthnot Lane. I have modified it a little, so that the rubber can be tightened at will, and so that it causes a sharper flexure of the walls of the viscus over the bar. (Fig. 112.) Two

clamps are placed, a long one on the stomach and a short one on the duodenum, each being well clear of the disease. They ought to be placed perfectly parallel and in the same plane, so that they may serve as guides in the future apposition as well as clamps during the resection.

Resection of the Diseased Structures.—The walls of the stomach are best divided by successive cuts with a scissors. Bleeding vessels are ligatured or forced-pressed as they are divided. The direction of the incision is guided by the shape of the growth: but the mode of its completion will depend on where it is intended to insert the duodenum into the divided end of the stomach. If there is much dilatation of the stomach, Wölfler's advice, to insert the duodenum close to the greater curvature, will be followed. In this case, the upper section of the stomach-walls may be at once sutured before completing the removal of the diseased mass. In his later operations Billroth, in lessening the calibre of the divided end of the stomach so as to fit the small opening of the duodenum, did not divide the mucous membrane at the end of the incision, but removed a V-shaped flap composed only of peritoneum and muscular coat. The edges of this gap are brought together by stitches, which do not include the mucous membrane, this layer being bent inwards towards the cavity of the viscus. Threads placed in the peritoneal coats prior to complete division insure that there is no rotation of stomach or duodenum, and that they are united in their natural planes. No definite instructions applicable to every case can be laid down: the lines of division, the sites of apposition, and the mode of suturing, must be decided upon by the operator.

As the division is being made, catch-forceps are placed on bleeding points, and care is taken that any intestinal or gastric fluids are immediately mopped up, and the cloth or sponge removed from, and not re-introduced into, the field of operation.

Joining the Intestine to the Stomach.—This, the crucial part of the operation, has been performed in a great variety of ways. The

variety of method has been too great and the cases have been too few for any final selection of a best method to be made. The nature of the case ought, in some degree, to be a guide to the method of operative junction to be followed. These methods may be classified as follows:—

A. Junction of the end of the open duodenum to the open incision in the stomach. Gastro-enterorrhaphy.

I. By simple suturing.

II. By medium of—

(1) Absorbable tubes or bobbins.

(2) Murphy's button.

B. Closure of duodenal and gastric openings, and lateral approximation of intestine and stomach. Gastro-enterostomy.

I. Directly by suture.

II. Mediatly by aid of—

(1) Absorbable plates.

(2) Absorbable tubes or bobbins.

(3) Murphy's button.

C. Closure of gastric opening and implantation of duodenum into gastric walls.

I. Directly by suture.

II. Mediatly by aid of—

(1) Absorbable tubes.

(2) Murphy's button.

This, it will be admitted, provides variety enough to satisfy the most capricious taste; it does not, however, exhaust all the methods which have been employed. Fortunately, some of the methods work out their own exclusion. In some cases it is impossible to approximate duodenum and stomach; here duodenum and stomach are closed, and jejunum and stomach are approximated. In other cases the condition of the patient absolutely forbids any prolonged operation; and here time-saving devices by means of button, plate or bobbin have their special value. The operation of election would, with most

surgeons, probably be direct suture of duodenum to stomach without any mediate assistance of tubes or bobbins; the great objection to this plan is the time occupied in carrying it out. One, two, or even three hours have been recorded as being occupied in the operation.

Broadly speaking, we may fairly condemn any method of pylorectomy which occupies more than one hour; the patient's tolerance can scarcely last longer. And then objection to direct suturing may arise from great thickness of gastric walls, with excessive attenuation of the duodenum. The variations in conditions are almost too numerous to specify; the surgeon himself at the operation must decide as to the method to be employed.

The methods selected for description are:—

- I. Junction of stomach to duodenum by simple suturing.
- II. Junction of stomach to duodenum by the aid of absorbable rings or bobbins.
- III. Murphy's method by his button.
- IV. By Gastro-enterostomy or after-closure of gastric and duodenal openings by approximation of stomach and intestine.

Junction of Duodenum to Stomach by Sutures.—The opening of the stomach being larger than that of the duodenum, two sets of sutures will be necessary—one for uniting the duodenum to the stomach, the other for closing the opening in the stomach itself. Circumstances must determine at the time whether it is better first to suture the superfluous gap in the stomach, or first to insert the duodenum into the space retained for it. Probably, in most cases, part of each proceeding will be finished before concluding the whole of either.

Wölfler's suggestion, that as many sutures as possible be placed from the inside, is a valuable one. The lips of the incision are inverted, so as to bring peritoneal surfaces into contact, and the first rows of stitches are inserted and tied from the mucous aspect. As the openings are gradually closed,

it will become less easy to place these inner sutures, and then the double row must be inserted from without. About a third or more of the suturing may be done partly from the inside and partly from the outside; the rest must be done entirely from the outside. However applied, the sutures are essentially the Czerny-Lembert. At the part where the transverse line of sutures in the duodenum meets the longitudinal line in the stomach, a few extra stitches should be inserted.

Nearly all operators have used the simple interrupted suture. Inserting and tying a double row of these, which must be very numerous—from forty to sixty,—necessarily occupies a great deal of time. I can see no objection to the employment of the continuous suture, interrupted, as Pollock suggests, after every four or five stitches. For the inner row, if inserted from the mucous aspect, the continuous suture would seem to be particularly suitable. In one case I used two continuous sutures—one, a deep suture going obliquely through the outer coats and inserted after each cut of the scissors, so as to stop the bleeding and close the opening; the other, a superficial suture inserted after the first line of union had been infolded. This was found three days afterwards, at death, to be perfectly united. In this case the disease extended some way along the duodenum, part of which was removed, so that union between duodenum and the remaining portion of stomach would have been impossible. Gastro-jejunostomy, therefore, was performed by means of Senn's decalcified bone plates; and here also union was found to be perfect. A minute perforation had appeared in the closed duodenum, which was excessively thin, and would scarcely hold a stitch, and through this extravasation of bilious fluid had taken place.

Fine Chinese silk is the favourite suture-material: catgut has been used; but there is danger of its being absorbed before union is firm. The needles now proved to be most suitable for this and similar work on the intestines are straight, round milliner's needles, about two inches in length. For resection of the pylorus some twenty or thirty needles should be provided.

Direct suturing of duodenum to stomach may also be carried

out by Maunsell's method.* His method as applied to enterorraphy will be described further on. For gastro-enterorraphy its advantages are not very conspicuous, and the operation will not be described.

Junction of Duodenum to Stomach by Means of Sutures over Absorbable Tubes.—This, one of the oldest methods of performing enterorraphy is, I believe, one of the best, and may with propriety be applied to gastro-enterorraphy. The method falls to be specially considered under Enterorraphy, and will be detailed here only so far as the actual steps of the operation are concerned.

The operation is suitable only for those cases where the stomach is not much dilated; where the disease is limited in extent, or extends rather into the duodenum than towards the stomach; and where approximation of the divided viscera can be made without undue traction. This should include at least half of all cases suitable for operation of any sort.

The tube which I prefer is made of decalcified bone, and is shaped as in the section shown in Fig. 113. It is a little curved; is broader at the gastric than at the intestinal end, and has a groove or sulcus in the middle broad enough to take the incurved walls of the viscera. The lips overhang the groove so as to grasp the visceral walls; at the bottom of the groove are perforations which carry any discharges directly into the tube.



FIG. 113.

The junction is made simply by drawing the divided ends into the sulcus by purse-string sutures, and superadding a row of continuous or interrupted sero-serous sutures. A simple overlapping purse-string suture is placed in the divided end of the duodenum by six or eight insertions passing through all the

* *Amer. Journ. Med. Sc.*, March, 1892.

coats and grasping about one-eighth of an inch of tissue. The thin end of the tube is then placed in the duodenum and the divided end of the duodenum drawn into and buried in the sulcus by tightly tying the suture. The same proceeding is carried out with the stomach, the whole gastric opening being, if possible, gathered into one suture. A little manipulation may be required to get the gastric extremity well buried in the sulcus; and care should be taken to see that no part of the incised margins is visible. If the gastric opening is too large to be gathered into one suture and fixed in the sulcus on the tube, part of the opening may be closed separately as in simple suturing, and the remainder employed to effect the junction. The operation is concluded by the insertion of a continuous Dupuytren's suture all round the junction.

The operation thus performed is simple and easy. On the only occasion in which I have employed this method the operation from first to last occupied only half an hour and was successful. The separate closure of a portion of a too large gastric opening would complicate the proceeding only a little; and if reversal of the purse-string suture at the junction with the Lembert sutures were made, the risk from leakage ought not to be perceptibly increased.

Pylorotomy by the Murphy Button.—The operation as performed by the bone tube may be done by the Murphy button. But as Murphy himself recommends a different method, this method alone will be described. He places one half of the button in the end of the duodenum, and the other half in a fresh incision made in the gastric wall. He thus* describes his method:—

“First, ligate the mesentery on the upper side of the stomach, pylorus and duodenum, as a broad pedicle, with from three to four double ligatures and cut between. Second, ligate the mesentery on the under side in the same manner; the pylorus can then be lifted well up into the abdominal incision. Third, pack thoroughly around with gauze and place two clamps on the stomach, one above and the other below the place to be incised.

* *Lancet*, April 27th, 1895.

Fourth, a circular incision is then made in the stomach, including the peritoneum and muscularis; this is pushed back half an inch and the mucous membrane cut off; the latter is rapidly closed with a continuous suture; the serosa and muscularis are then closed with a continuous Lembert. Two clamps are placed on the duodenum and it is excised. Fifth, one half of the button is then placed in the end of the duodenum, and the other half in the posterior wall of the stomach, one inch from the line of suture, and pressed together."



FIG. 114.

*Murphy's Button.
Type suitable for
Junction of Duodenum
to Stomach.*

The button sets itself free by pressure atrophy or by gangrene, and is passed by the rectum. Up to date of publication but four operations by means of the button were recorded, with three recoveries. This record is too scanty to draw conclusions from, but as far as it goes it is certainly promising.

Function by Gastro-enterostomy, or closure of duodenal and gastric openings and lateral approximation of intestinal and gastric openings, may be an operation of necessity or of choice. It is necessary if it is impossible to approximate duodenum and stomach on account of extensive removal of tissue. Its results have been so good, however, that it may take place as a competitor with other operations; and gastro-enterostomy may be performed even when there is a possibility of direct junction of duodenum and stomach. The openings in the stomach and the duodenum are closed, and there is made lateral approximation and junction of intestine—duodenum, or preferably jejunum—with the stomach.

The closure of duodenum may be made by a combination of continuous and of interrupted sutures. A continuous suture passing through serous and muscular coats is carried round the gut about a quarter of an inch from its divided extremity. As the suture is tightened, the indrawn extremity is turned

inwards towards the centre of the bowel by forceps on its margins, and the gut is closed by a purse-string ligature which approximates serous surfaces only. A second continuous suture is placed over the doubled-in extremity, and a third may be placed over all. This proceeding occupies only a few moments.

Puckering sutures should be sparingly or not at all applied to the stomach. Separate closure of the mucosa and the musculature after separation of the two is probably the best method; but it occupies longer time and is associated with more free bleeding than mass suturing of the whole. A deep row of Lembert sutures and a superficial Dupuytren suture would probably be the best method.

For the further steps—the apposition of stomach and intestine—the reader is referred to the operation of Gastro-enterostomy to be next described.

The connection between intestine and stomach having been satisfactorily made, the parts are thoroughly cleansed, the sponges and sponge-cloths are removed, and the organs replaced in the abdomen. If it can be done without undue disturbance of parts, a piece of omentum is grafted to the line of junction, so helping to strengthen the barrier against extravasation into the cavity.

The parietal wound is sutured in the ordinary way.

After-Treatment.—For the first day or two, or longer if the patient's strength will bear it, all food by the mouth is withheld, and the patient is fed on nutrient enemata. The first food should be liquid in small quantities and peptonised. Meat has been given on the fifth day after operation; but unless there is urgency it is wise to incur no unnecessary risk by prematurely disturbing the gastric wounds by giving foods which will cause gastric peristalsis. If the Murphy button has been used, feeding by the mouth may be begun at once. This is certainly one conspicuous advantage of the employment of this method.

Gastro-enterostomy.

This operation is the establishment of a permanent fistula between the stomach and some part of the small intestine. Gastro-duodenostomy means, more specifically, the making of a fistula between stomach and duodenum; gastro-jejunostomy, between stomach and jejunum.

History.—Wölfler of Vienna first performed the operation on September 27th, 1881. He began with the intention of performing pylorotomy for cancer; and finding the operation impracticable on account of adhesions to the pancreas, he performed gastro-enterostomy. The patient lived four months. Billroth and Lauenstein followed, each with one case, in the same year.

Conditions for which the Operation may be Performed.—Gastro-enterostomy was introduced as an ameliorative proceeding in cases of *cancer of the pylorus*, where the disease could not be removed. The high mortality of pylorotomy and the frequency of recurrence of the disease after operation, led some surgeons to urge the advisability of abandoning the radical proceeding altogether and substituting gastro-enterostomy. It was hoped that the reduction of the general mortality after gastro-enterostomy would more than counterbalance the diminished duration of life amongst the patients that recovered after pylorotomy. This hope has scarcely yet been realised.

For *Cicatricial Stenosis of the Pylorus* gastro-enterostomy has been performed by Rydygier and Monastyrski, and here it may be considered as a rival of pylorodiosis and pyloroplasty. In cases where the stenosis is extreme and the thickening is very great, gastro-enterostomy would probably be a safer and more satisfactory operation than either divulsion or incision of the stricture; and here there is no doubt a true reason for the performance of the operation. Again, recurrence of the stenosis

after local operation would be an indication for gastro-enterostomy.

In *Gastric Ulcer* treatment by gastro-enterostomy has been followed by an encouraging amount of success; and it is possible that in selected cases of this disease the operation may come into general use.

As a *Final Step after Pylorectomy* the operation has been frequently performed. Some surgeons hold that closure of the gastric and duodenal wounds, and lateral approximation of jejunum and stomach, forms the best termination of pylorectomy under all circumstances. Whether this be true or not (and facts are not yet sufficient to enable us to pronounce a final judgment), there is no doubt that, in a certain class of cases and always in those where stomach and duodenum cannot be approximated, gastro-enterostomy should always be the last step after pylorectomy.

Appreciation and Mortality.—We have not sufficient grounds on which to base conclusions as to the value of the operation. So far the actual results have not been quite up to expectation. Winslow* collected 13 cases of operation, of which 9 died. Eight operations have been performed in Billroth's Clinic, with 5 deaths. The longest survival after operation for cancer up to date was in a case operated on by Barker of University College, London, where the patient lived one year and one week. Rockwitz† collected 22 cases. Complete cures were got in 2 cases of simple stricture; 5 were alive at periods between one and seven months; 4 recovered from the operation, but died in a few weeks; in the remaining 11 (50 per cent.) the operation greatly hastened the patient's death. Mr. H. Page‡ has collected 36 cases (the two preceding are omitted or overlooked), of which 20 recovered. The mortality is less over its first cases than was that of pylorectomy; but still, it is very large. Five died of collapse. Two died of kinking of the bowel at the site of junction to the stomach. Hæmorrhage, peritonitis, and exhaustion are among the other causes of death.

* *Amer. Journ. Med. Sc.*, April, 1885. † *Deutsche Zeit. f. Chir.*, June 22nd, 1887.

‡ Meeting Roy. Med.-Chir. Soc., May 14th, 1889.

Groups of cases have been reported in support of special methods of operating. Thus Magill,* in support of the method by decalcified bone plates, records 47 successful operations, being a percentage of recoveries of 77.05. Bowerman Jessett † records 5 operations so performed with 2 deaths. With the Murphy ‡ button the operation has been performed 27 times, with 9 deaths. In four of the successful cases the button dropped into the stomach; but in none, it is said, did it give rise to any unpleasant symptom.

On the other hand, using no special apparatus, Hahn§ records 15 gastro-enterostomies without a death. And Doyen || has a record even more brilliant, with 21 operations and no death.

The general mortality, at its best not under 30 per cent., seems almost too high for an operation intended not to save life, but only to prolong it, and that only for a few months. The cases of survival over a year or more are very rare: the average duration in cases of undoubted cancer can not often be longer than six months. The operation having a purpose analogous to that of colostomy for cancer of the rectum, is inferior to it in respect of prolonging life and relieving pain, while it has a higher mortality. If after ten years experience we are likely to lose a third of our cases of gastro-enterostomy for cancer, it is doubtful whether the operation should be retained amongst justifiable surgical operations.

The gratifying success of certain operators, such as Hahn and Doyen, promise to place the operation on a more favourable footing; and we may hopefully wait to see whether their good results will be extended.

In cases not cancerous the operation will doubtless continue to have a legitimate application under the conditions specified.

THE OPERATION.

Preparatory.—The stomach should, if possible, be empty. But no special means, such as the stomach tube, causing worry and

* *Annals of Surg.*, Sept., 1894. † *Brit. Med. Journ.*, 1892, vol. i, p. 119.

‡ *Lancet*, April 27th, 1895. § *Deut. med. Woch.*, Oct. 25th, 1894.

|| *Traitement Chirurgical des Affections de l'estomac et du duodenum*, 1895.

distress to an already weak patient should be employed. Abstinence from food for four or five hours before operation, and having the last meal composed of peptonised and soluble concentrated material, will fulfil the end. A stimulating enema should be administered before operation. Should fluid be found in the stomach during operation, this can easily be removed by syphon action with a large tube.

Parietal Incision.—A considerable variety of incision has been adopted, but a median incision between umbilicus and ensiform cartilage is on the whole the best. It should be a long one, not less than three inches; longer, if the parietes are thick or unyielding. The delivery of part of the stomach and a loop of intestine cannot be conveniently done through a cramped incision. It may be carried below the umbilicus.

Fixing the Intestine to the Stomach.—This has been done in many different ways. Some of the methods rest only on experimental or limited practical experience, and will not be described. Of those which have been tried and found satisfactory in a fair number of cases, the following are in my opinion the best :—

- I. By simple suturing of the apposed margins of the gastric and the intestinal openings.
- II. By the aid of Senn's decalcified bone plates.
- III. By the aid of absorbable tubes or bobbins.
- IV. By means of Murphy's button.

On the whole, I prefer the method by simple suturing, and for these reasons. Firstly, it has had the lowest mortality. It is true that some forty cases are not sufficient to draw final conclusions from; but that these have resulted in almost no mortality, is a fair presumption that in a greater number of cases the mortality would not be high. Secondly, it provides a large opening. There is undoubtedly a tendency for this, as for all other bi-mucous fistulæ, to contract up to a certain point; and a few cases have shown contraction almost to the extent of obstruction.

The larger the original opening, the greater the certainty of permanence of the fistula. There is no getting over these facts of low mortality and large opening; they are of prime importance as regards the immediate and the ultimate success of the operation. Therefore I consider that simple suturing should be the operation of election.

In favour of the other methods, by aid of tube, plate, or button, the chief argument is, that they save time. In the case of a weak patient, this saving of time is an element of the first importance. How much time these accessories save in a given case, it is impossible to say; it will vary almost indefinitely, according to the skill of the surgeon. An inexperienced surgeon, or one who is not deft in suturing, will give his patient the best chance by using the aids mentioned: an experienced and dexterous operator may, in ordinary cases, ignore these aids; in extraordinary cases he may be glad of their assistance.

As to the *Parts to be Approximated*, there is a general opinion in favour of uniting the jejunum to the anterior surface of the stomach. To bring the duodenum at any part up to the stomach has been found to cause too much traction, and the same may be said of the first six inches of jejunum. Attempts to unite the jejunum to the posterior wall of the stomach after perforation of the transverse meso-colon, or the gastro-colic omentum, have resulted in at least two deaths from kinking of the gut, and this proceeding is now abandoned. The great omentum is pulled up and pushed to the right, as Jessett advises, and the jejunum is brought over it on to the anterior surface of the stomach. To find the beginning of the jejunum, the pancreas, and the transverse meso-colon are used as guides. The beginning of the jejunum is the only fixed part of the small intestine, and is found below the pancreas, usually without any difficulty. The seat selected for junction with the stomach should be from a foot to a foot and a half from its fixed origin at the duodeno-jejunal flexure, so that there shall be no traction on either stomach or bowel under the freest possible movements. The bowel is carried over the omentum, pushed to one side; the transverse colon is pushed backwards, and the site of apposition to the stomach fixed upon;

while the parts are, as far as possible, made extra-peritoneal by packing of sponge-cloths and sponges all around. It is said to be important that the upper end of the bowel should be towards the cardiac end of the stomach, so that the peristaltic waves shall be in the same direction. On the viscera the junction should be made about the middle of the anterior surface of the stomach, rather towards its lower border; and on the bowel, half-way between its free border and its mesentery.

We have now outside the parietal wound a fold of stomach and a loop of jejunum, and the seats of junction between the two are fixed upon. The viscera are carefully isolated in cloths or sponges wrung out of warm antiseptic lotion. The subsequent steps vary according to the mode of union decided upon.

Union by Simple and Direct Suturing.—The intestine is first clamped, after being squeezed empty on both sides well away from the seat fixed upon for opening and suture—a clear space of about five inches being left. Two clamps of Lane's or of the modification already described (Fig. 112) are placed transversely to the mesentery, so that the intestinal fold shall be at the seat of incision. The incision may at once be made through all the coats of the bowel, and should be from two and a half to three inches in length. Catch forceps are placed on bleeding points and left there. The few drops of fluid which escape from the bowel are mopped up at once and fresh cloths or sponges placed around.

A fold of the gastric wall, corresponding in size to the incision in the gut, is pinched up and divided while it is held well forwards, catch forceps being placed on the bleeding points. If there is much fluid in the stomach which shows a tendency to escape, this should at once be removed by syphonage or suction. A skilful assistant by keeping the incised walls well forward may obviate the necessity of emptying the stomach.

The two ends of the incisions are now united by separate single sutures. These may be either sero-serous perforating only the serosa and muscle,⁷ or they may perforate all the walls. The posterior lips of the incisions are then united by a continuous

overlapping suture which perforates all the coats, while the assistant keeps them in contact by stretching and judicious manipulation. As the stitches are inserted the forceps are removed, when all bleeding will have ceased. Here the stitches may be pulled tight after each insertion. The same proceeding is carried out with the anterior or upper lips of the incisions; only here, for obvious reasons, insertion is facilitated by leaving the stitch loops loose till all have been inserted. The edges are turned in as the sutures are tightened, so that the serous surfaces are in apposition. The edges of the incisions all round are now accurately joined by sutures that perforate the visceral walls. It is necessary to place an additional row of re-inforcing sutures outside. These may be continuous or interrupted and are of the ordinary nature, passing through the serous and muscular coats only and not entering the mucosa. The Lembert or Halsted sutures are the best of the interrupted varieties for this purpose; the Dupuytren suture is the variety of continuous suture recommended. These are fully described under Enterorrhaphy, to which the reader is referred.

Barker * in a successful case modified the operation by making the incisions in the first place only through the serous and muscular coats. I quote his words: "Still holding the parts, as before, between finger and thumb, I now united the posterior edges of the wound by a continuous suture, the needle entering and emerging in each case between mucous and muscular coats, and the threads crossing the cut edges of the muscular and serous coats. In this way the serous surfaces were closely united from end to end before either viscus was opened. The row of stitches (which were about an eighth of an inch apart) was carried about a quarter of an inch beyond each end of the incision in the coats of the bowel. The moment had now come to open both the stomach and intestine completely; and this was done with a stroke of the scissors through the mucous coat in each case, special sponges being ready to receive any fluid which might escape. After careful cleansing, the anterior borders of both openings were now united by a row of inter-

* *Brit. Med. Journ.*, Feb. 13, 1886.

rupted fine silk sutures, introduced according to Czerny's method. When this was completed, the two openings were securely closed; but as an extra precaution, the intestine was turned over, and the posterior suture was reinforced by a second row of interrupted sutures, placed at about a quarter of an inch away from the first. The anterior row was then similarly reinforced by a row of continuous sutures, taking up, as before, only the serous and muscular tunics."

Union by means of Senn's Decalcified Bone Plates.—The introduction of flat absorbable discs for the purpose of maintaining the apposition of the walls of hollow viscera we owe to the genius of Senn* of Milwaukee and Chicago. Their value, first tried and proved in the lower animals, has now been fully proved for human beings.



FIG. 115.

Senn's Decalcified Bone Plate.

The method of employing these discs is practically the same throughout the whole gastro-intestinal tract, and may be fully described here. In connection with intestinal obstruction and resection the method will again have to be referred to, and certain modifications will have to be described. Its simplest application is in the operation now under consideration.

After shutting off the general lumen from the part to be operated upon, two longitudinal incisions are made through the walls of the viscera to be approximated. The best incision is a longitudinal one on the convex aspect of the bowel most distant from the mesentery, the length in dogs being from an inch and a-half to two inches, corresponding to one from two to two and a-half inches in human beings. The stomachic incision, if the operation is gastro-enterostomy, is of equal length: through the two incisions are inserted oval-shaped perforated bone plates, with four threads attached, one thread near to each end of the oval; the other two at the sides of the perforation. The lateral threads perforate all the coats of the bowel. (Fig. 116.) Silk was the material preferred for the threads, but Jessett gives

* *Trans. Internat. Med. Congress, Copenhagen*, vol. i., p. 140.

cogent reasons for the employment of chromicised gut. The two plates were approximated by tying the threads, the knots being buried between the serous surfaces. The plates then held firmly in contact and at perfect rest two large areas of serous surface, which quickly became agglutinated and united by organised tissue. The decalcified plates soon broke up or dissolved in the stomachic and intestinal fluids, and the opening was established. The perforations in the plates in the meanwhile prevented danger from intestinal obstruction.

The directions given for preparing the bone plates are as follows. It must be remembered that these were for employment in dogs, and that they must be of greater size for use in the

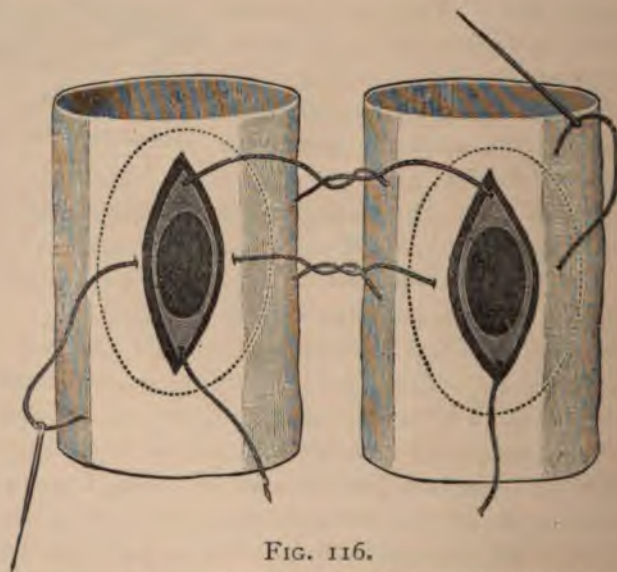


FIG. 116.

Diagram showing the employment of perforated bone-plates in the formation of Intestinal Anastomosis. The dotted outlines show the limits of the plates.

human subject. "The compact layer of an ox's femur or tibia is cut with a fine saw into oval plates one-fourth of an inch in thickness, two and one-half to three inches in length, and an inch in width. The plates are then decalcified in a ten per cent.

solution of hydrochloric acid, changed every twenty-four hours until they have become sufficiently soft, and can be bent in any direction without fracturing. After decalcification, they are washed by letting water flow over them from three to six hours, so as to remove the acid. The plates are then covered with porous paper, and compressed between thin pieces of tin until they are perfectly dry. If, during the process of drying, the plates are not compressed between two smooth surfaces, they become disturbed by warping. The hardened plates are next drilled several times in a straight line in the centre, and the openings enlarged and connected with a file until the opening is five-eighths of an inch in length, and about one-eighth to one-sixth of an inch in width. The sharp margins of the plate and perforation are removed with a file. With a fine drill four perforations for the sutures are made near the margins of the oblong perforation—one at each end, and one at each side. For preservation, the plates are kept in absolute alcohol. When the plates are to be used they are washed in a two per cent. solution of carbolic acid, and the threads or sutures attached by threading two fine sewing needles each with a piece of aseptic silk twenty-four inches in length, which are tied together." The needles are used to perforate the walls of the viscus at the margins of the opening, and the plates are approximated and tied. Before tying the sutures, the peritoneal surfaces should be scratched to promote the exudation of lymph and so accelerate the formation of adhesions; and, after tying, it will be wise to insert a few Lembert's or Dupuytren's stitches between the serous surfaces at the margins of the plates. Grafting a piece of omentum or fixing unsevered omentum by a few fine sutures over the united wound may afford additional security against perforation if there is any reason to fear this accident.

The abdomen is cleansed and the parietal wound closed in the ordinary way. The after-treatment need in no way differ from that of other operations upon the stomach. A report of the state of parts in a case a month after operation, by Dr. G. T. Beatson of Glasgow,* is instructive. "On opening the abdomen, a coil

* *Lancet*, Oct. 11th, 1890.

of small intestine was found attached along the greater curvature of the stomach from a point about five inches and a quarter from the pylorus; but in the last inch and a half, or thereabouts, the union was extremely intimate, and the surface of the intestine passed insensibly by the medium of strong adhesions with polished surface into that of the stomach. . . . The aperture between the stomach and the intestine was oval with smooth regular borders, and barely admitted the index-finger. The bone plates had quite disappeared, but the silk sutures of apposition seemed quite unaltered." This unaltered condition of the silk sutures leads Dr. Beatson, as similar experiences have led others, to recommend the employment of chromicised gut instead of silk in such operations.

Various objections to the bone-plates have led numerous experimenters, chiefly American, to seek for other materials. Davis of Birmingham, Ala., has suggested catgut mats; Matas of New Orleans, a solid cat-gut ring; and Brokaw, of St. Louis, a clever arrangement of catgut threads inside segmented soft rubber tubing. The obvious advantages of catgut as to absorbability and rapidity of preparation led me to make some simple experiments with it in compressed discs and rings as well as in threads. The disadvantages are, that it swells very much and so might produce pressure necrosis, and that it becomes distorted and so might cause gaps to form between the two plates or rings. Robinson of Toledo* tried plates of cartilage from the young ox, but found that they absorbed too quickly; and after trials of many other materials, found that raw hide plates were most satisfactory. "The raw hide plate is made by shaving the hair from the green hide of an ox. Then cut the hide into strips an inch wide and two inches and a-half long. Perforate the plate by a diamond-shaped aperture (half an inch by three-quarters of an inch). Then apply four to six sutures to the plate, armed with four to six needles, and it is ready for use. The plate can be used dried or green. If the hair is shaved from the green hide, and then the hide is dried, it thickens and stiffens

* *N. Y. Med. Journ.*, Oct. 18th, 1890.

so that almost any kind of plates suitable to any part of the alimentary canal can be obtained." If such plates are kept in stock for operation, they ought to be more than an inch in breadth—two inches by three would be a convenient size; they could easily be pared down at the time of operation, if found too large.

Junction by means of Absorbable Tubes or Bobbins.—This method is an application of the very old one already referred to under Pylorotomy. The tube, intended for side-to-side approximation and not for end-to-end, is much shorter, and the lips of the groove in it are extended into flanges. (Fig. 117, which, however, is intended to show the small size suited for cholecyst-enterostomy.)

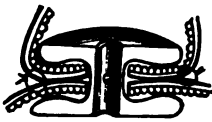


FIG. 117.

*Approximation of Walls
of Viscera by means of
Flanged Decalcified
Bone Tube.*

Decalcified bone is perhaps the best material yet devised. Mayo Robson has been the chief advocate of this method of operating; he calls the tubes "bobbins," and has used them with great success in every variety of operation on the hollow viscera.

The proceeding is very simple. The incisions are made in the stomach and the intestine exactly as for direct suturing, and two continuous sutures are placed around the incised openings ready for tying around the collar of the button after it is placed in position. One half of the button is pushed through the gastric opening, and the suture tightened and tied; and the same is done with the intestinal opening. The flanges keep the gastric and intestinal walls in fairly accurate apposition, but a continuous sero-muscular suture will be necessary to re-inforce and make water-tight the junction of the visceral walls.

The objection to the tube or bobbin is, that a very large tube and still larger flanges would be necessary to provide a sufficiently large opening, and that the continuous constricting sutures around the visceral openings tend still further to cause narrowing after the decalcified bone has been absorbed. Now, the necessity of the provision of a large opening in gastro-enterostomy has been so

abundantly proved that we should hesitate to adopt any method, however safe and simple, in which this provision is not secured.

Provided the tube is large and the approximation is close, the method may be recommended as good. It is doubtful if, under any circumstances, it is superior really to the method of direct suturing. It saves time; but such saving must be reckoned by a few minutes at most, for gastro-enterostomy performed by suturing in the manner described is by no means a long operation.

Union by means of the Murphy Button.—This, from the surgeon's point of view, is the simplest and speediest of all methods. The viscera are approximated as for the other methods, and incisions are made in their walls large enough to admit the halves of the



FIG. 118.

Insertion of Continuous Suture around Incision preparatory to insertion of Murphy's Button. (MURPHY.)

Murphy button. Continuous sutures placed around the margins of the incision draw the openings closely around the collars of the two halves of the button. The halves are then joined, the button locked, and the operation is finished. No outside sutures are necessary.

The objections to the button are, the necessarily small opening left by a button which must pass the ileo-cæcal valve, and the chance that the button may fall into the stomach instead of into the intestine. The small size of the opening is an objection of strong weight, as has been proved in its actual working, and it is not easy to see how it can be overcome. The direction in which the button shall escape may be partly influenced by decubitus, and this has been suggested and tried.

Also making the attachment to the posterior surface of the stomach has been recommended and carried out, so that the button may have a tendency to fall backwards into the bowel. The objections to this method on the ground of causing kinking of the bowel have already been stated. If the button falls into the stomach, it will probably require removal by operation. This, of course, is simple enough and not very dangerous; but the possibility of such a necessity is against the method.

To diminish the likelihood of contraction various methods have been devised, by which there is produced an actual removal of tissue at the opening. Postnikow* cut out oval flaps of the serous and muscular coats, tightly tied the mucosæ, so that it should slough, and joined the edges of the incisions in the viscera. The communication was made when the two mucosæ sloughed away. As this might not happen for days or even weeks, the disadvantages are obvious.

Paul† has suggested a method whereby sloughing of the contiguous walls may be induced by the help of a decalcified bone ring introduced into the bowel and fixed by ligatures inside the stomach after gastrostomy. The uncertainty of the period when the slough is cast off seems to me to be against the employment of this method.

After-treatment.—The treatment after gastro-enterostomy is the same as after other operations on the stomach; namely, rest to the organ for a day or two, and then cautious administration of easily-absorbed liquid foods in small quantities. Rectal feeding should be begun from the time of operation and continued until the patient is able to take a sufficiency of food by the mouth. Hahn lays stress on the importance of washing out the stomach from twelve to twenty-four hours after operation.

Duodenostomy.—This is the establishment of a duodenal fistula through which nourishment is passed into the bowel. It is performed as a mode of relief in cases of pyloric stenosis, under circumstances similar to those for which gastro-enterostomy is carried out. The operation has not been done often. Langen-

* *Centralbl. f. Chir.* xlix., 1892. † *Lancet*, July 15th, 1893.

buch of Berlin performed the first operation, in 1879; and Robertson, Southam, and a few others have operated in recent years. None of the reported cases have recovered. Two of them have been performed for cicatricial stenosis, and would probably have been better treated by forcible dilatation.

The operation is found practically not to be so difficult as might be expected. In health, it would scarcely be possible to bring the duodenum up to the abdominal wound; but in disease, the attachments of the duodenum are stretched, and the bowel is usually displaced downwards with the dilated stomach, so that it can without much difficulty be brought to the surface. Langenbuch and Southam performed the operation in two stages—postponing the opening of the bowel for seven and three days respectively. The principles of operation are essentially the same as in gastrostomy for stricture of the œsophagus, and need not be again repeated.

Jejunostomy.—This is the same proceeding as duodenostomy, carried out for a similar purpose, only a little lower down in the bowel, where it is less closely attached and more easily drawn to the surface. Pearce Gould, Golding-Bird, Ogston, and others have performed the operation in England. Ogston's case was very successful; the others were failures. A few scattered cases are recorded; but the operation is still in its infancy, and little can be said about it. It seems theoretically to be a better operation than duodenostomy, as regards facility of performance: as regards the worth of it, as offering an opening for the supply of food, there is probably little to choose between them.

If in any case in which pylorotomy was contemplated, and found, after making the parietal incision, to be impracticable, it is still considered advisable to give the patient a chance of prolongation of life, then I believe that the choice lies between gastro-enterostomy and jejunostomy. If the patient is fairly strong and is bearing the operation well, gastro-enterostomy should be selected; if it appears advisable to shorten the proceeding as much as possible, jejunostomy may be substituted.

The operation requires no special description. The jejunum may be found by pushing aside the omentum, and is drawn to the surface, sutured to the abdominal wall, and opened, either at once or later on, as in gastrostomy. The value of peptonised foods in the subsequent treatment of the case is likely to be conspicuous.

Gastrectomy, or total extirpation of the stomach, was begun in 1883 by Connor of Cincinnati,* but was not completed, as the patient died on the table. He intended, after removing the stomach, to unite the cardia to some part of the small intestine. He says nothing as to how the vitality of the colon is to be provided for, and produces insufficient evidence to show that the operation is either feasible or proper.

Partial Gastrectomy, for cases where a malignant growth is situated in the walls of the stomach away from the pylorus or cardia, would seem to be a proceeding easier than pylorotomy, and likely to be followed by greater success. So far as I know, the operation has not yet been performed.

Intubation of the Pylorus, for stenosis, has been carried out by Hahn of Berlin. He performed gastrostomy, then carried a tube through the stenosed pylorus into the duodenum, and left it there. The patient lived three weeks. Forcible dilatation would now, in all probability, be preferably adopted.

* *Phila. Med. News*, Nov. 22nd, 1884.

Operations for Ulcer of the Stomach.

Pathological Anatomy.

Diagnosis of Ulcer of the Stomach.

Diagnosis of Perforation.

Acute Perforation.

Chronic Perforation.

Operation.

In Non-Perforating Ulcer.

In Perforating Ulcer.

In Acute Perforation with General Peritonitis.

In Chronic Perforation with Localised Abscess.

After-treatment.

The surgical treatment of gastric ulcer has not yet, except in its broader features, passed beyond the tentative stage. Operations of every conceivable variety, done on the spur of the moment or previously planned, have been performed for ulcer in all its stages and for all its complications. But for none of its stages or complications can it be said that clear and precise rules of proceeding have been laid down. Nor, considering the inherent difficulties of the subject, is it likely that such rules will be soon forthcoming. Meanwhile it will be of advantage to put forth such principles as practice and study have provided.

Pathological Anatomy.—Here it is unnecessary that I should give a detailed account of the pathology of ulcer of the stomach. Only those points which have a surgical bearing are dwelt upon.

Two varieties of ulcer are described, the acute and the chronic. The acute ulcer is usually small, round, and appears as if punched out of the stomach-wall. The chronic ulcer may attain to considerable size, has shelving or irregular margins and appears funnel-shaped. Each variety causes bleeding, and each tends to perforate the wall of the viscus. The chronic ulcer tends to heal, often forming adhesions to surrounding organs in

doing so; and the result of this healing is often cicatricial contraction of the gastric walls. The acute ulcer if it heals leaves no contracting scar.

Gastric ulcer is four times more frequent in women than in men. In young women the disease specially occurs between 14 and 30; in men, curiously enough, the age-incidence is between 35 and 50. Martin,* in 171 cases, found 15 under 20 years of age, 75 between 20 and 30, 38 between 30 and 40, and in regular diminishing frequency up to old age, 4 only being over 60.

The acute ulcer is rarely more than an inch in diameter, often half this size; has perpendicular sides, not thickened or swollen, but deeply congested or blood-stained, and it often contains small pieces or tags of necrosed tissue. It goes right through all the coats and perforates the peritoneum by an irregular, jagged opening. Frequently there is more than one ulcer, usually they lie near to each other. The situation may be anywhere; they are supposed to favour the pyloric region, and they are not so often found on the posterior wall as the chronic ulcer.

The chronic ulcer has, as already remarked, a shelving margin, and its walls are thickened, sometimes to an enormous extent. This thickening is due chiefly to an increase in the submucosa; but all the coats partake in the thickening. The sides of the ulcer may show the coats in steps or shelves down to the peritoneum, which, usually much thickened, may alone form the base. The muscular coat often forms the floor; when it is perforated it may retract, so increasing the size of the ulcer and causing thickening of its margin. There is a tendency for the base of the ulcer to attach itself to any contiguous organ, which is not movable. Thus adhesions to the pancreas are quite common; sometimes it adheres to the liver and rarely to the spleen. On the front, where all the organs in contact with the anterior surface of the stomach are movable, extraneous adhesions are rare. As the formation of extraneous adhesions either prevents or limits perforation and extravasation, it will be

* *Dis. of Stomach*, London, 1895, p. 398.

understood why perforation is more common on the anterior than on the posterior surface. The ulcer may be as small as the acute ulcer, but it may attain to dimensions much greater. Ulcers as large as the palm of the hand have been described, and four inches by two often represent the diameters. The largest ulcers are horse-shoe shaped; they are usually near the pylorus and spread towards the lesser curvature. Most often they lie on the posterior surface. This indeed is true of all ulcers, that they lie chiefly on the posterior surface of the stomach, and along the lesser curvature; while the great majority (more than three-fourths according to Martin) are found in the pyloric region.

The majority of ulcers heal—12 out of 13 do so. The scar left after healing contracts and causes puckering of the mucous membrane around, with some lessening of the area of gastric walls. This contraction may result in modification of the shape of the organ. When near to the pylorus one result is obstruction to the outflow of food, with dilatation or hypertrophy of the organ. Cicatrisation of an ulcer in the middle of the stomach may result in hour-glass contraction.

Perforation is the termination which chiefly interests the surgeon. This result, according to Brinton, takes place in 13½ per cent. of all cases; according to Habershon, in 18 per cent. It is more common in females, because the disease is more common in them; but the actual proportion of perforations to cases is greater in males. Thus in Brinton's 234 cases of death from perforation, 160 were females and 74 were males. As already stated, perforation is most likely to take place if the ulcer lies on the anterior surface, where there is no solid fixed organ for it to adhere to. Here there is sudden extravasation of gastric contents into the peritoneal cavity. In posterior ulcers where there is adhesion to pancreas or spleen the contents do not escape into the general cavity, but into a cavity of varying dimensions, whose walls are a circumscribing or protective mass of adhesions passing between the peritoneal coverings of the stomach and the attached organ. According to Dreschfield,* the ulcer perforates on the anterior surface 85

* *Manchester Med. Chron.*, Nov., 1887.

times out of 100 cases; while on the posterior surface only 2, and in the pylorus only 10, out of 100 perforate.

With a sudden perforation and no protective adhesions, there is extravasation of the stomachic contents into the peritoneal

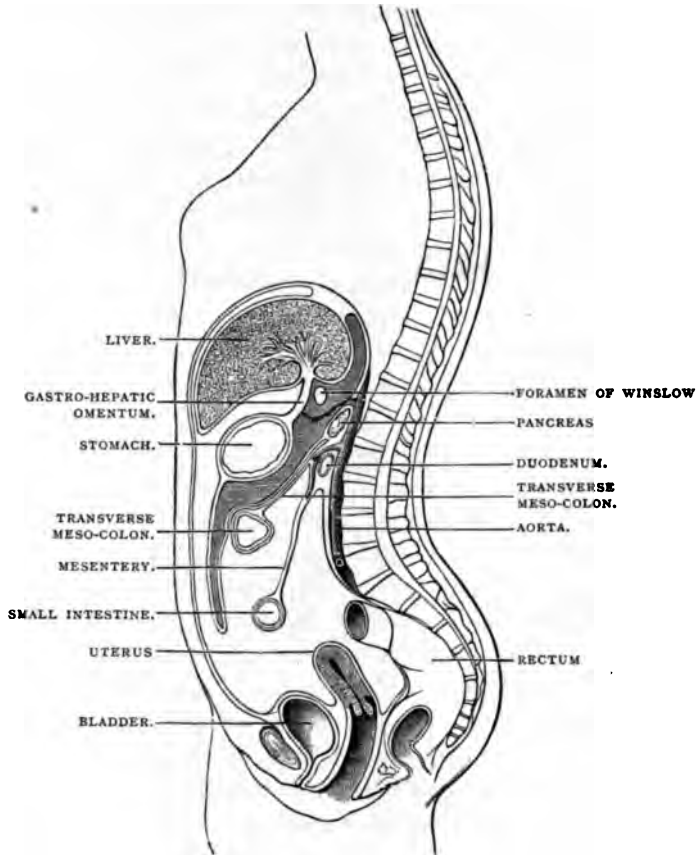


FIG. 119.

Diagram to show the Peritoneum as seen in vertical section. (ALLEN THOMPSON, from Morris's Anatomy.)

cavity. As perforation often takes place after a full meal, this may mean a sudden outpouring of several pints of fluid into the peritoneum. In perforation of the anterior wall the fluid, after

filling the gastro-hepatic space, flows over the great omentum and soon diffuses through the intestines into the lumbar and pelvic hollows. In perforation of the posterior wall the lesser cavity is first filled, then the fluid escapes into the general cavity through the foramen of Winslow. There is no attempt at limitations; when any hollows or cavities are filled they overflow and diffusion soon becomes general.

Protective adhesions are formed under two conditions. Firstly they are started in immediate contiguity to the ulcer, binding it to some organ, such as the pancreas. Perforation takes place and a small but slowly extending abscess is formed, into which the gastric fluids have access. This abscess slowly increases and may burrow into the organ—liver, spleen, or pancreas—which forms part of the abscess-wall. Such an abscess may burst and become diffuse, when the results are similar to those in simple diffuse perforation. The second variety of limiting adhesion has presumably a different origin. It is determined by the anatomy of the parts rather than by an extending inflammatory process. Thus, in perforation of the anterior wall of the stomach, the adhesions will be found between the omentum and the parietes, preventing downward excursion of the fluids; and lateral extension may be prevented by the falciform ligament of the liver. The lesser cavity may be closed by adhesions at the foramen of Winslow. The origin of such adhesions must be something as follows: There is an outpouring of gastric fluids in moderate amount, sufficient to fill any contiguous cup or hollow, but not sufficient to diffuse through the general cavity. Following its universal habit, the peritoneum here, in the presence of foreign matter, endeavours to isolate or encapsule it by adhesions all round. These form on stomach, liver, spleen, diaphragm, and, wherever two organs join, the adhesions glue them together. The limits of the abscess are determined by the size of the extravasation. In diffuse or abundant extravasation the patient dies before adhesions have formed; in small extravasations localised by the anatomical dispositions of the parts, encapsulisation may take place.

These extravasations form the majority of the examples of

sub-phrenic abscess. The anatomical relations of a sub-phrenic abscess are surgically of the greatest importance. The surroundings and limitations of the abscess, possible and probable, determine the nature of the operation and guide in the cleansing and drainage. It is unfortunate that accurate data are not available on which to build guiding rules. Such post-mortem descriptions as have been reported are mostly either defective in completeness, or involved in description, or anatomically impossible. Clinical descriptions are, for obvious reasons, of little assistance to the surgeon.

Certain broad facts in connection with the anatomy of the parts and the recognised disposition of sub-phrenic abscess from perforation of the stomach may, however, be illustrated; they help, if they do not fully serve, to give an understanding of the limitation and distribution of the encysted fluids.

The point of first importance relates to the position of the perforation as regards the gastric surfaces, whether in front

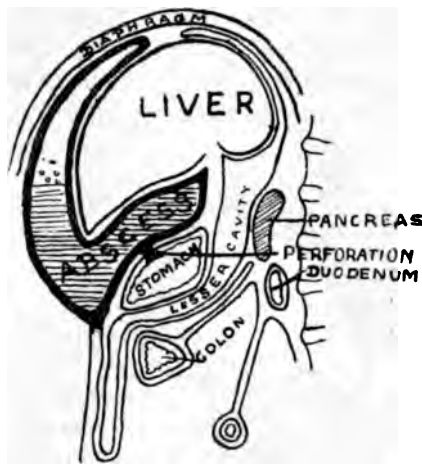


FIG. 120.

Diagram of Sub-phrenic Abscess from Perforation of Anterior Wall of Stomach.

or behind. In Fig. 120 the perforation is shown in front. The gastro-hepatic hollow is filled up, and the fluid lies in a cup, the bottom of which (with the patient supine) is the gastro-hepatic omentum and gastro-phrenic ligament; and the walls the anterior surface of the stomach below and the liver and diaphragm in front. This is in its complete development. The liver here, in its anterior half, cuts into and is contained in the abscess; the fluids cannot get behind it above for the coronary ligament, and below it is limited by the parts at the transverse fissure. The adhesions limiting the downward excursus of fluids are between

the omentum and parietes; but such adhesions may join the liver margin to the omentum, and then the fluids do not rise up under the diaphragm at all. Again, such an abscess may be, and in fact usually is, only one half of that shown. It is limited to the right or the left side—usually to the left—by the falciform ligament of the liver. This means that adhesions have joined the omentum, the parietes, and the edge of the liver at the notch, but have left the edge of the left lobe free.

The second variety of abscess fills the lesser cavity of the peritoneum, and originates from perforation of the posterior wall of the stomach. It may also originate from perforation of the duodenum on its peritoneal aspect, and from other causes connected with the pancreas or spleen.

The truly subphrenic portion (Fig. 121) of the abscess is on the

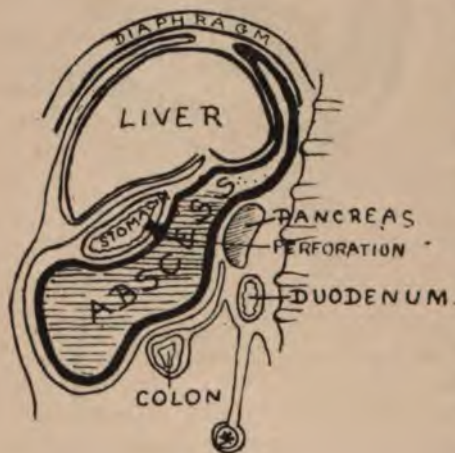


FIG. 121.

Diagram of Subphrenic Abscess from Perforation of the Posterior Wall of the Stomach.

posterior half of the diaphragm behind the coronary ligament, and involves the surface of the Spigelian lobe of the liver. The downward descent of the sac would depend on the position where the omental folds adhere and also on the amount of fluid effused. The foramen of Winslow would probably be plugged by adherent bowel; but, curiously enough, reports of such cases rarely refer to the foramen at all.

A variety of subphrenic abscess which can scarcely originate in gastric perforation, but may arise from perforation of the duodenum where it is uncovered by peritoneum, and is usually caused by burrowing suppuration from kidney or colon or

appendix vermiformis, is shown in Fig. 122. The abscess lies behind the peritoneum, elevates the bowels with their mesentery, and burrows under the peritoneal covering of the diaphragm to an indefinite extent. This variety will be fully considered later on; and is here referred to simply for clinical completeness.

Diagnosis of Ulcer of the Stomach.—The clinical features of ulcer of the stomach need not be dwelt upon. The well-known symptoms of vomiting, localised pain after food, and bleeding as shown in the vomit and the stools; the age and sex of the patient, usually a young female, and the presence of chlorosis with its associated signs in cardiac murmurs and deficient red blood-cells, are well known. The nature and position of the pain is one of the most important diagnostic signs. Caused as it is by a raw sore on the stomach surface, it is usually suddenly produced by the introduction of food and especially

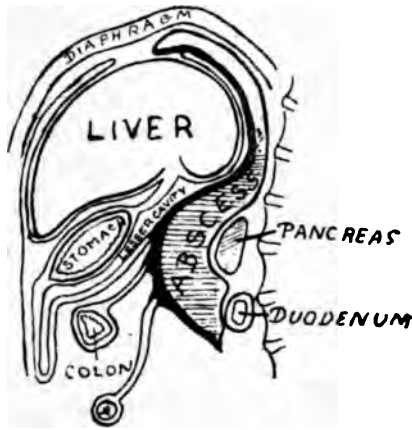


FIG. 122.

Diagram of Retro-peritoneal Subphrenic Abscess.

by hard or indigestible lumps; as digestion goes on and the movements of the stomach proceed, and the gastric juice is poured out, the pain is aggravated. As the activity of the digestive processes abates, the acuteness of the pain diminishes. Rejection of the food by vomiting at once gives relief. Posture may relieve the pain: thus, lying on the left side may relieve pain caused by an ulcer at the pylorus; the prone posture may relieve pain from an ulcer on the posterior surface; the supine posture may give relief in ulcer on the anterior surface. Posture, however, is an uncertain help in diagnosis. Distension of the stomach from any cause produces pain.

The seat of the pain is usually localised, and at this seat there

is tenderness on pressure. The painful area is at the epigastrium in front, and behind on the left of the spine, at the roots of the last two ribs. Often the area of pain and tenderness is quite small, being no more than an inch in diameter; usually it is larger and frequently varies in extent. Sometimes the pain is more marked in the back than in the epigastrium; the reverse is usually the case. In front deep palpation may sometimes be required to elicit the pain; but usually the patient shrinks on moderate pressure. The pain never shifts its position; it remains in the same place all through the illness. It may increase or diminish, or disappear, but where elicited it has always the same situation.

Vomiting varies usually according to the severity of the pain; those cases with most severe pain have most regular vomiting. Usually it comes on from half an hour to an hour after food; but sometimes it is delayed for two hours or more. Hæmatemesis occurs in about 80 per cent of all cases. Melaena occurs in all cases of hæmatemesis, and, according to Martin, in about 11 per cent. of the cases which have no vomiting of blood. The variations in the amount of bleeding, from a few drachms to many ounces are great. A small ulcer tapping a large artery may cause profuse bleeding; a large ulcer may be attended with little more than capillary oozing.

Diagnosis of Perforation.—We have to diagnose between acute perforation with diffusion of the gastric contents through the general cavity of the peritoneum, and chronic perforation with limitation of the extravasated fluids inside an inflammatory sac. This latter condition is also known as subphrenic abscess.

Acute Perforation is signalled by the following symptoms: pain, collapse, tympanitic distension of the abdomen with fixity of the parietes, thoracic respiration and frequent retching with ineffectual vomiting.

The pain is usually very severe and comes on in paroxysms. It may supervene on some unusual exertion or strain or may follow the taking of a meal. In many no apparent cause is observed. Collapse may be profound from the beginning, and in

a few hours may cause death. In some the collapse is only nerve-shock caused by the severe pain. As true collapse increases, becoming profound and constitutional, the pain diminishes.

Tympanitic distension is not immediate; the first result is a tense, board-like rigidity of the parietes. This is partly voluntary but chiefly reflex. This parietal muscular spasm prevents distension; but it is evident that there is great increase of intra-abdominal pressure. All abdominal movements cease. Resonance is highly tympanitic all over the abdomen. Associated with this condition we sometimes find the very important sign of disappearance of the liver-dulness. This sign is important because it indicates the presence of free gas in the abdominal cavity, and can scarcely arise from any other cause than perforation of an air-containing viscus such as the stomach or intestine. The value of this sign is greatest when elicited early in the case; as, later in the progress, it is liable to be confused with general intestinal distension, or special distension of the transverse colon. It is a presumptive sign in favour of the presence of gas in the cavity if it quickly changes its position with that of the patient, always rising to the highest part of the abdomen.

Vomiting is nearly always absent in acute perforation, although there is usually nausea with retching and eructations. Vomiting is probably a mechanical impossibility: the contracting stomach discharges its contents into the general cavity through the perforation and not through the gullet.

If the patient survives, signs of peritonitis soon appear. The superficial, quick thoracic respiration; the fixed hard, tense, and perhaps distended parietes; the quick, thready, feeble pulse, and the profound general disturbance, clearly indicate the oncome of peritonitis in aggravated form. The temperature is misleading: in the worst cases it is subnormal. At the end we observe the pinched, anxious countenance; the diminution or disappearance of pain; the dusky, cold, clammy skin; and the quick, flickering pulse, which indicate the approach of death. This is the natural and usual termination. A very few cases, too few to be for a moment considered in drawing up rules for treatment, have recovered. In these cases it is safe to infer that the opening

was small and the exudation slow and small in amount. An abundant and rapid extravasation of the fluid contents of the stomach into the general abdominal cavity may be regarded as certainly fatal if not treated by operation.

Chronic Perforation—as it has usually been called, or *subacute* or *limited perforation*, as it might more accurately be named—has a different and more complicated symptomatology. The first onset may be sharp and acute; or slow and insidious; usually there is a short, sharp attack, of gravity not alarming, followed by chronic signs which remain stationary or slowly become serious. I have operated on a hospital case where there was an enormous abscess of the first variety (Fig. 120), in which the onset was so insidious that no date could be fixed to it, and the patient almost up to the day of operation was able to walk about and give attention to her household duties. The rule, however, is, that there is an acute attack of pain in the upper abdomen which soon becomes diffused; that this is followed by vomiting; and that grave general illness supervenes. Difficulty of breathing is usually present, but cases are recorded where this was absent. We should always expect dyspnoea if the diaphragm were involved in the mischief, and the urgency of it would vary according to the area invaded. If the mischief extends through the diaphragm into the thorax, and pyo- or pneumo-thorax supervenes, the grave symptoms incidental to these complications may confidently be reckoned upon. Cough, though often present, is by no means always so.

The diagnosis rests mainly on the physical signs. These relate chiefly to a swelling or bulging in the upper abdomen and to certain changes in the percussion notes which are got over the liver, heart, and lungs. In the first variety (Fig. 120) the bulging is most marked in the epigastrium, raising the abdominal walls immediately below the xiphoid cartilage. If the abscess is confined to the left side, the swelling will be most marked there, and similarly of the right side; a collection on both sides of the falciform ligament would be symmetrical. But neither symmetry nor a-symmetry will be marked wherever the

abscess is; a general vague bulging of the whole infrasternal hollow is what we may expect. In the second variety (Fig. 121) the bulging is lower, and may even go below the umbilicus. In the third variety (Fig. 122) local bulging is not observed; the whole of the upper abdomen is full and perhaps distended.

Palpation doubtfully reveals a collection of fluid, or of mixed gas and fluid, under low tension and not giving a thrill. In the first variety, a line of induration underlying and adhering to and moving with the parietes may be felt crossing the line of the collection from side to side. This marks the site of the adhesions between omentum and parietes which check the downward diffusion of the abscess, and is a sign of great importance. In some cases this induration may be attached to the liver margin. In two cases which I have had, and on one of which I operated, this line of thickening running across the abdomen below the fluid collection was the most important single sign in making the diagnosis. In the second variety, this thickening, if present at all, would be lower down, somewhere in the omentum, and would not be firmly fixed to the parietes. In the third variety no thickening would be palpable.

The edge of the liver may be palpated; often the whole organ is displaced downwards.

Percussion reveals important signs, more especially if the collection contains gas as well as fluid. These signs have been well worked out by clinical physicians and deserve close attention. (*See, particularly, Ewart, Clin. Journ., July 25th, 1894.*)

In the third variety, unless in the rare event of the collection reaching the surface, percussion is useless. In the second variety, variations in the percussion note do not invade, or at least do not overly, the hepatic area, and are limited to the seat of the bulging. In the first variety, the collection may more or less completely envelop the anterior portions of the liver; and as such a collection often contains gas, it is here that percussion gives the most valuable help in diagnosis. The diagnosis is then simply one of subphrenic pneumo-thorax, as it is usually called. But it must not be forgotten that pneumo-peritoneum in the upper abdomen is not proof of subphrenic

abscess; nor is its absence proof that subphrenic abscess does not exist.

The simplest condition is where the whole liver is surrounded by the collection. Such a case I have been able closely to study in hospital; and the state of parts was verified at operation and post-mortem. Downward progress was limited by adhesions between omentum and parietes. When the patient lay supine anterior liver-dulness was completely absent. The liver margin was easily palpable, and the whole organ was slightly depressed. Cardiac dulness was normal. When the collection is right-sided, the right lobe may be depressed and the whole liver tilted; a left-sided collection depresses the left lobe and removes its dulness. In connection with left pneumo-peritoneum, cardiac percussion reveals signs of some importance. The heart is not laterally displaced to any extent, and its apex-beat, displaced outwards only a little, may usually be easily felt. The curious point is, that the whole lower cardiac area may give a resonant note continuous with that over the collection of gas. This resonance of an undoubtedly solid body in the neighbourhood of a gaseous collection is a clinical fact which I have often observed in examining the abdomen. Ewart's suggestion that the note is conducted by the heart substance, as by a pleximeter, seems the most likely explanation. The diaphragm in these subphrenic collections is usually described as raised. It is more easy to depress the diaphragm than to raise it; and downward displacement of liver is more likely to take place than upward displacement of the diaphragm. In true pneumo-thorax, downward displacement of the diaphragm, and with it, of the liver, is of course well marked.

These symptoms and signs relate mainly to the large or fully developed abscess; and it is remarkable that so many of them are of the large size described. But, in some cases the abscess is small and never comes to the surface, and perhaps produces no physical signs to help in diagnosis. These cases are rarely diagnosed until they cause secondary rupture, when it is often too late. The clinical and post-mortem reports of cases of perforating gastric ulcer do not definitely enough differentiate

between the two varieties; both are classed as perforating ulcer simply. Until we have more knowledge we can scarcely be more precise in rules for diagnosis and treatment.

OPERATION FOR ULCER OF THE STOMACH.

The operative treatment of ulcer of the stomach is still under discussion. It is true that a good many operations have been performed with the view of curing the condition, and that a certain amount of success has been achieved; but it cannot be said that treatment by operation has secured the support of surgeons everywhere. For this the inherent difficulties in diagnosis and the difficulties, occasionally almost insuperable, in operating are to blame. If the seat of a gastric ulcer could be located and were accessible in its location, there is no doubt that operation for cure of gastric ulcer would soon become general.

The attention of surgeons is being keenly turned to the subject, and already some notable facts have been placed on record. It is my purpose shortly to indicate the lines which these studies have taken, and to note the directions in which operative treatment is most likely to be successful.

The first operation for the cure of ulcer of the stomach was performed in 1881 by Rydygier.* There was a large ulcer on the posterior surface of the pylorus, with great distension of the stomach. The ulcer was adherent to the pancreas, and there was much thickening of the gastric walls. He resected the diseased tissues by a very difficult operation, and the patient made a good and permanent recovery. The operation was generally condemned. In 1882 Czerny† operated on a case of large ulcer on the posterior wall also with dilated stomach. Through an incision in the anterior wall he resected the ulcer, and the patient recovered and rapidly gained weight and strength. A similar operation was performed by Van Keef‡ in the same year, also with successful result. At the German Congress of

* *Berl. Klin. Woch.*, 1882, No. 3. † *Archiv. f. Klin. Chir.*, xxx. 1.

‡ *Centralbl. f. Chir.*, 1882, p. 756.

Surgery in 1894 Schuchardt related a case of excision of an ulcer, in which death took place in a fortnight from a second undiscovered ulcer. In 1893 Roux of Lausanne recorded at the French Congress of Surgery a case of successful resection of a small ulcer which opened the coronary artery and caused very copious hæmorrhage. Two other cases by Rydygier with one death, four by Mikulicz* with two deaths, and a few other stray cases exhaust the records for operation done on rational diagnoses.

Other operations have been performed where a tumour was palpated through the parietes. Czerny's second case was of this sort, as were the operations of Novaro in 1889; of Maydl in 1891; and of Doyen in 1893. Here the possibility of the growth being malignant adds a justification and motive for the operation which these other cases without tumour had not. Other cases with their results are mentioned and summarised in an excellent monograph by Comte of Geneva.†

The treatment described refers to excision. Doyen of Rheims‡ has in gastro-enterostomy introduced another mode of treatment. At the German Congress of Surgeons he reported a consecutive series of 21 gastro-enterostomies for ulcer causing pyloric stenosis or spasm. All recovered from the operation, and in most there was conspicuous improvement or cure. He applies surgically the principle of rest to the ulcer which the physician seeks to secure by abstention from food by the mouth and feeding by the rectum. There is no doubt that unrest, and especially dilatation of the stomach, are causes of the want of healing in the ulcer; and where pyloric stenosis exists, gastro-enterostomy would do away with these drawbacks to healing. Gastro-enterostomy has been performed by Czerny, Monod, Durivier, Küster, Novaro, and others, with a gratifying amount of success.

For an ulcer on the pylorus, Pyloroplasty by the Heineke-Mikulicz method has been performed by Curtis of New York,

* *Centralbl. f. Chir.*, 1895. † *The Med. Week*, 1895, III., No. 39.

‡ *Centralbl. f. Chir.*, 1895, July 6th, and *Traitement chirurgical des affections de l'estomac et du duodenum*, 1895.

Doyen, and a few others. Such an operation is performed as much for the stenosis as for the ulceration, and can scarcely be included amongst those for pure ulcer.

Comte's collection of cases gives 38 operations with 9 deaths, and either cure or great relief in the 29 cases of recovery from operation. The mortality is too high to justify operative proceeding in simple ulcer unless its existence has been very prolonged, or the occurrence of grave complications greatly endanger the patient's life. Only then in exceptional cases where the disease has continued over years and makes the life of the individual a burden; or where great pain, or constant vomiting, or repeated attacks of hæmatemesis actually endanger the life, operative interference will be justifiable. A very free hæmatemesis is an indication for operation, for it means ulceration of a large vessel, and is liable to recur and cause death.

If operative interference seems to be justifiable, what is to be the nature of the operation? There are strong arguments against excision of the ulcer. Firstly, there is the mortality of Comte's 17 cases—6 deaths. It is true that nearly all the patients were greatly enfeebled from the disease and ill able to bear any serious operation; still, the mortality is too high. Then, in many cases the ulcer is out of reach and cannot be satisfactorily excised; in other cases the ulcer is multiple,—every fifth case is multiple. Great size, although not so great a barrier as unfavourable situation, may still be almost prohibitive of excision. Adhesions often are present to an extent which renders resection of the ulcer very difficult and dangerous. On these and similar grounds excision as a mode of treatment for ulcer of the stomach is not to be recommended.

Pyloric divulsion and pyloroplasty have been performed in cases where there was pyloric stenosis with the ulceration. This is not treatment of a pure ulcer, and so may be considered out of place here. Anyhow, where there is ulceration with stenosis, pylorotomy is by most surgeons recommended as preferable to any partial procedure. There can be no disputing this, if the patient will bear the operation. Perhaps a little more risk might be justified by the more perfect result.

All things considered, Gastro-enterostomy seems to be the procedure of most promise for gastric ulcer. Doyen's results giving no death in 21 operations, and 12 other cases by other surgeons with one death and almost universal improvement or cure, are more than encouraging—unexpectedly so in my opinion. Doyen considers that it cures by abolishing the reflex spasm of the pylorus, which is the chief factor in causing dilatation, hæmatemesis, and perforation. It permits the ulcer spontaneously to heal. It does surgically and more perfectly what abstention from food and rectal feeding do medically at the expense of partial starvation.

I would venture to lay down the following conclusions and rules for the surgical treatment of gastric ulcer :

I. The operation is to be done only for the more serious cases. The special indications are, severe or repeated hæmatemesis, and very prolonged continuance of the symptoms, with advancing dilatation of the stomach and general debilitation of the patient.

II. The first step in all cases is to be gastrotomy. This is to be made in a position suitable for the double purpose of exploration of the cavity of the stomach, and of performing gastro-enterostomy should this be decided upon. The incision may be made longitudinally through the middle of the anterior wall of the stomach, nearer to the pylorus than to the cardia, and need not at first be longer than an inch.

III. The next step is digital exploration of the cavity of the emptied stomach ; the left forefinger would be used for the left half of the stomach, the right forefinger for the pyloric end. If the ulcer cannot be discovered by touch inside, the fingers carried outside into the general cavity (of course after purification) seek for adhesions which, if present, will indicate the position of the ulcer inside. The use of a speculum through the gastric incision may also be suggested.

IV. When discovered, catch-forceps are placed on the indurated margin of the ulcer, and by traction on the forceps the ulcer is pulled up to and through the gastric incision. The incision will probably have to be enlarged ; and the enlargement is made towards the right or the left, according

to the position of the ulcer. An ulcer at the pylorus could rarely be pulled through the gastric incision ; then direct exposure by prolonging the incision to the right is to be carried out. An ulcer near to the œsophageal end of the stomach cannot thus be pulled to the surface ; here direct treatment is either difficult or impossible, and gastro-enterostomy may be the only resource. Adhesions binding the ulcer to underlying organs may, if not old and firm and abundant, be cautiously separated by the finger outside the stomach ; if the reverse holds true, they are best left alone.

V. Direct treatment of the ulcer is now considered. Resection as a deliberate measure is generally excluded. But in the special case of a small ulcer, easily accessible, and causing perforation of any of the large vessels, resection and suture should be carried out and the gastric incision closed. Other measures which the surgeon would have in view might be something as follows :

(1) The insertion of a continuous puckering suture of silk which passes across the surface of the ulcer, diminishes its size and prevents its physical enlargement. Such a suture would put the ulcer at rest, would diminish the raw surface, and possibly stimulate the callous base into active life. It would remain in position for several weeks and then probably be cast off and voided by stool.

(2) The liberation of the margins of the ulcer from the retracting muscle all round the ulcer, and suturing the mucosa. This would be a more serious proceeding than the former ; but it would permit more accurate closure and perhaps expedite healing.

(3) The infolding from the peritoneal aspect of the ulcer, and the union by sutures of the apposed folds. This proceeding would probably be limited to the more accessible ulcers, and especially to those in the anterior wall.

VI. An active ulcer at the pylorus with much thickening is best treated by pyloric resection. If from adhesions the difficulty of the operation is great, or if the patient is very weak, then gastro-enterostomy should be performed.

VII. In every case where, for any reason, the ulcer cannot directly be dealt with, or where the operative tolerance of the patient is slight, gastro-enterostomy should at once be performed. Also in every case where there is any doubt as to the result in direct treatment of the ulcer, gastro-enterostomy should be performed.

The operative details in gastrotomy and gastro-enterostomy and pylorotomy are described under their special headings, and need not here be recapitulated.

OPERATION FOR PERFORATING GASTRIC ULCER.

A good many operations have been performed for gastric perforation. Barling* has been able to collect and tabulate 37 operations; 31 of these being early operations for acute perforation, and 6 for localised collections such as subphrenic abscess. There were 13 recoveries, only two of the recoveries being in the second or chronic class. Comte† has collected 65 cases of operation for general peritonitis caused by gastric perforation—of these, 46 died and 19 recovered; for localised abscess he collected 23 operations—of these, 11 recovered. To Comte's collection of cases a few others, including two of my own, might be added. Altogether about 100 operations have been performed, the death-rate, as near as one can judge, being for the acute cases about 70 per cent., for the chronic cases about 55 per cent. This is high, but it is better than would be got by leaving the cases to nature, where the mortality is certainly over 90 per cent. Early diagnosis and early operation with improvements in technique will doubtless lower the operation mortality; but it is certain always to be high. With its present mortality, operation is already fully justified: indeed operation immediately on the diagnosis of perforation is nothing less than imperative.

Operation in Acute Perforation with General Peritonitis is performed with the fullest possible preparations for keeping the

* *Birm. Med. Rev.*, 1895, vol. xxxviii., No. 204. † *Loc. cit.*

patient warm, for treating collapse, and for cleansing the peritoneal cavity. A specially heated operation table, or numerous hot-water bottles packed round the patient, with bandaging of the limbs over heated cotton-wool, and such accessory devices to maintain the bodily warmth as will suggest themselves, should never be neglected. A capacious irrigation apparatus, with large tubing and suitable glass nozzles through which an abundant stream of fluid can be conveyed, will be ready. The reservoir should not be more than three feet above the level of the patient, as the stream should be abundant rather than forcible. The nature of the fluid is not very important if it is pure. I favour boro-glyceride solution, about an ounce to the pint of distilled water; but saline solution or simple distilled water do almost equally well. The fluid should be about 105° Fahr. temperature. An abdominal macintosh, plastered round the wound, conveys the out-flowing fluid into a receptacle under the table. Abdominal retractors, a dozen soft sponges with long-handled sponge-holders, and the ordinary instruments necessary for *cœliotomy*, are provided. A stimulating enema should always be given before operation.

The parietal incision is made in the middle line, between umbilicus and sternum, and should be at least three inches in length to begin with. According as necessity shows, it may be afterwards prolonged upwards or downwards or even transversely or obliquely through the left rectus. Considerations of subsequent ventral hernia here have no weight in view of the tremendous importance of easy and rapid access to the seat of mischief.

On division of the peritoneum, gas may or may not audibly escape; this is strong presumption, almost proof, of perforation. Unmistakable evidence is provided by the appearance of particles of undigested food at the incision. Often, but not always, the peritoneum is red and injected or even violently inflamed.

The seat of perforation is then looked for. In 43 of Comte's collection of operations, the seat of perforation is mentioned. It was in the anterior wall in 28 cases, in the posterior wall

in 8, in the lesser curvature in 4, and at the pylorus in 3. If it is at once discovered in the anterior wall, two pairs of large-bladed forceps are placed on its margins and it is pulled to the surface to be sutured by the surgeon, while his skilled assistant is cleansing the abdominal cavity. If it is not at once discovered the lesser cavity may be inspected, after tearing through the gastro-colic omentum; if it is free from signs of perforation, as shown by absence of gastric fluids or peritoneal injection, no further investigation may be made. High up in the lesser curvature or near to the cardia, the search need not be prolonged; for, even if discovered, the perforation can rarely be sutured. In every case search for the perforation is not to be prolonged at the expense of adding to the risk of the operation.

Cleansing of the cavity is proceeded with at once. If there is a collection of fluid anywhere, this is mopped out by sponging before irrigation is begun. If particles of food are diffused amongst the bowels, these are also removed, as far as is possible, by sponging. Irrigation should not be converted into a means of diffusing, but of removing foreign matter which sponges will not remove. When all gross filth is removed irrigation is begun. Two or three irrigation tubes may well be employed, these being placed in various situations; but one large tube, deliberately conveyed from pouch to pouch by the fingers, serves well. As already remarked, an abundant stream with low pressure is preferable to a small stream injected with force, as being less likely to cause shock. The intestines are freely moved about and shaken in the flood of water by the fingers. The aim should be to pass several gallons of fluid as quickly as possible through the whole cavity. The abdomen should be well filled before any of the fluid is permitted to run out. Cleansing is not likely to be effectual if the fluid is permitted to run out by the side of the glass cannula as it is introduced.

If the whole cavity is fouled, and particularly if the extravasated fluids have reached the pelvis, a secondary opening for irrigation and drainage may be made in the middle line over

the pubes. This may be made by direct incision on the finger inside pushing the parietes outwards. In either loin an opening may be made in the same way, for similar purposes.

When the cavity is cleansed and the fluid returns as clear as it entered drainage tubes are inserted. Large rubber tubes with thick walls which will not kink are most suitable. One tube is carried to the bottom of the hollow, near to the perforation where the chief collection of fluid lay; another is carried to the bottom of the pelvis, or elsewhere if considered necessary, through a special incision. Gauze drainage soon creates a closed lymph-tract around it and does not desiccate the whole cavity so satisfactorily as a tube. Strands of gauze or cotton are, as usual, passed down the tube to provide capillary action.

It is not necessary to remove the irrigating fluid; on the contrary, I believe it does good to have the intestines floating in a bath of boro-glyceride solution. The fluid soon drains away and is collected in large sponge cloths, wrung out of hot carbolic lotion, laid over the end of the tube. At the end of two or three days the lower tube may be removed; the tube lying near the perforation should be left for a few days longer until a fistulous track has been established, and then should be replaced by a smaller tube for about a week longer.

If the seat of perforation is discovered and is within reach, it is sutured while irrigation is going on. No attempt should be made to pare the edges or to resect the whole ulcer. In-folding of the serosa and the insertion of one or more rows of Lembert sutures, as in the performance of gastrorrhaphy are all that need be done. Owing to the unhealthy condition of the tissues around the perforation, perfect healing is not certain; therefore, even if the perforation is closed, drainage should not be abandoned.

It must not be forgotten that to graft a flap of omentum over the seat of suture may add to the immediate and remote security.

Operation in Chronic Perforation with Localised Abscess.— This is essentially the treatment of that variety of *subphrenic abscess*

which arises from perforation of the stomach. When once an abscess of this character is well protected, it is extraordinary how rarely it bursts and diffuses through the general cavity. Maydl, in a collection of 35 cases, records only two as bursting and diffusing. Death is practically universal, but it is rather from exhaustion or from minute diffusion towards the thorax with septicæmia, than from gross diffusion into the general peritoneal cavity. We may in fact, by our operation, render the peritoneum immune and fail to prevent the natural mode of death, by septic inflammation through the diaphragm and thorax. The operation is indeed rather to save the thoracic organs than the abdominal.

The purpose of operation is simply evacuation and drainage; no attempt, except in rare and favourable instances, is to be made to close the perforation. The question of irrigation is not yet decided. It is practically certain that no such abscess has its walls rendered germ-free by one irrigation; and it is possible that irrigation by breaking down the barrier of protective phagocytes may create the evil we seek to avoid.

The parietal incision will in most cases fall to be made on the middle line, between umbilicus and sternum. Bulging in the epigastrium, or the presence of a palpable inflammatory barrier traversing the parietes, directly indicates this as the best seat of incision. In doubtful cases this incision would still be the best. Where the collection is clearly behind the liver and there are thoracic complications, thoracotomy may be advisable. Five such operations have been done with three deaths. In such a case resection of a portion of a rib (the eighth and the ninth have both been chosen), in the mid-axillary line, is almost essential. The diaphragm is incised, before or after suture to the skin or parietal pleura, and the abscess is drained through this incision. This gives the most direct access to the abscess and provides dependant drainage. It ought not to be forgotten that such an abscess can nearly always be reached by making an opening through the gastro-colic omentum; that such a route for drainage does not enter the general cavity; and that dependant drainage can be got by turning the patient on the

left side. An abscess high up on the right side might be drained in the way suggested by Rutherford Morison for operations on the gall-ducts; namely, by an incision below the costal margin, below and to the outside of the right kidney. The surgeon in approaching a case should have all these points in view, and should, at a moment's notice, be prepared to adopt any one, or any modification of these practices.

The peritoneum being exposed, evidence at once appears in its condition as to whether it is involved in the abscess-collection. The escape of gas through the peritoneal puncture almost proves that there is perforation. A collection between the anterior wall of the stomach and the liver and diaphragm (Fig. 120) is at once apparent and is at once removed. For this purpose nothing is better than a Higginson's syringe; the valved extremity is placed at the bottom of the collection and the fluids are pumped out. Particles of food or other débris are removed by gentle sponging. If the stomach is not empty, it had better be emptied, either by squeezing it into the abscess sac, a slow process, or by pumping the fluid out through a small incision, which is at once closed. As the subsequent treatment will demand abstention from food by the stomach, it is well to start with the organ empty. To the variety of abscess which lies in the lesser cavity, access is secured by tearing through the omentum in the manner described, and the contents are removed and the walls gently cleansed by sponging in the same way.

Through one or other of these routes the abscess will always be discovered. If the patient has been treated in bed, as is usually the case (although I have personal knowledge of a patient going through the disease while walking about), the deepest parts of the abscess will be the anatomical limits; namely, the gastro-hepatic ligament in one case, and the coronary ligament in the other. The absence of subphrenic abscess should not be inferred until the limits of these barriers have been reached and fully explored.

If, in the judgment of the surgeon, irrigation is advisable, care should be taken that no adhesions are disturbed, and by

means of sponge-packing, that none of the fluid is diffused through the abdomen.

Drainage should be efficient and thorough. Large rubber tubes, perforated at points where necessary, are probably best. If the tubing has at any point to pass through healthy peritoneum, gauze should be wrapped round it so as to favour the creation of a lymph-barrier. A few strands of wick carried down the tube will help to keep the sac dry. The walls of an abscess sac a week old are very vascular and bleed readily; this blood clots and prevents satisfactory drainage. This is another reason for gentleness in manipulation. The efficiency of the drainage may be increased by making the patient lie on the side which makes the bottom of the pouch rise superior. This will usually be the right side. Cases of abdominal operation are, in my opinion, too uniformly treated in the supine posture: there is rarely any real reason for this at any time; and when there is a strong reason in favour of lateral decubitus, as there is here, this posture should be assumed. The capillary drain should frequently be removed and a fresh one placed in the tube.

If it is possible to make dependant drainage without adding greatly to the gravity of the operation, this should be done. Such an opening may be made by a stab incision from the outside in the costo-iliac space down to, and guided by the finger inside, the abdomen, at some point either below or in the front of the kidney.

After-treatment.—The patient should be fed entirely by the rectum for as long as possible, and mainly by the rectum at least for a week. By this time the perforation may have become sealed up; but gastric feeding should be carefully begun and warily watched for a week or two longer. The longer the rest the firmer the healing will become.

Locally the treatment is simply directed to absorbing any discharges from the tube and to seeing to its permeability. Gauze drains, if employed, should be removed about the fourth day.

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